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Toward an ecosystem reserve complex for the Canadian Rockies

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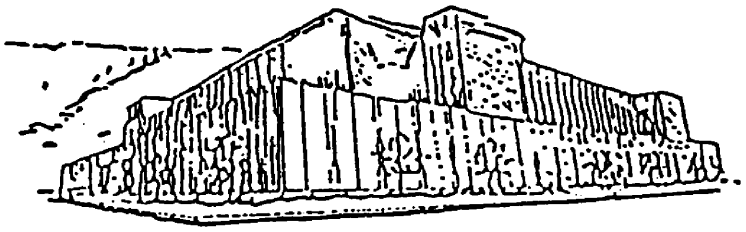

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TOWARD AN ECOSYSTEM RESERVE COMPLEX FOR THE CANADIAN ROCKIES

by

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B.S. The University of Oregon, 1986

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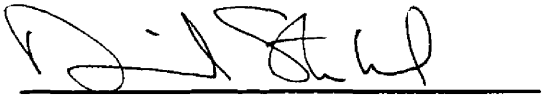

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The Need for Biological Reserve Planning in Canada

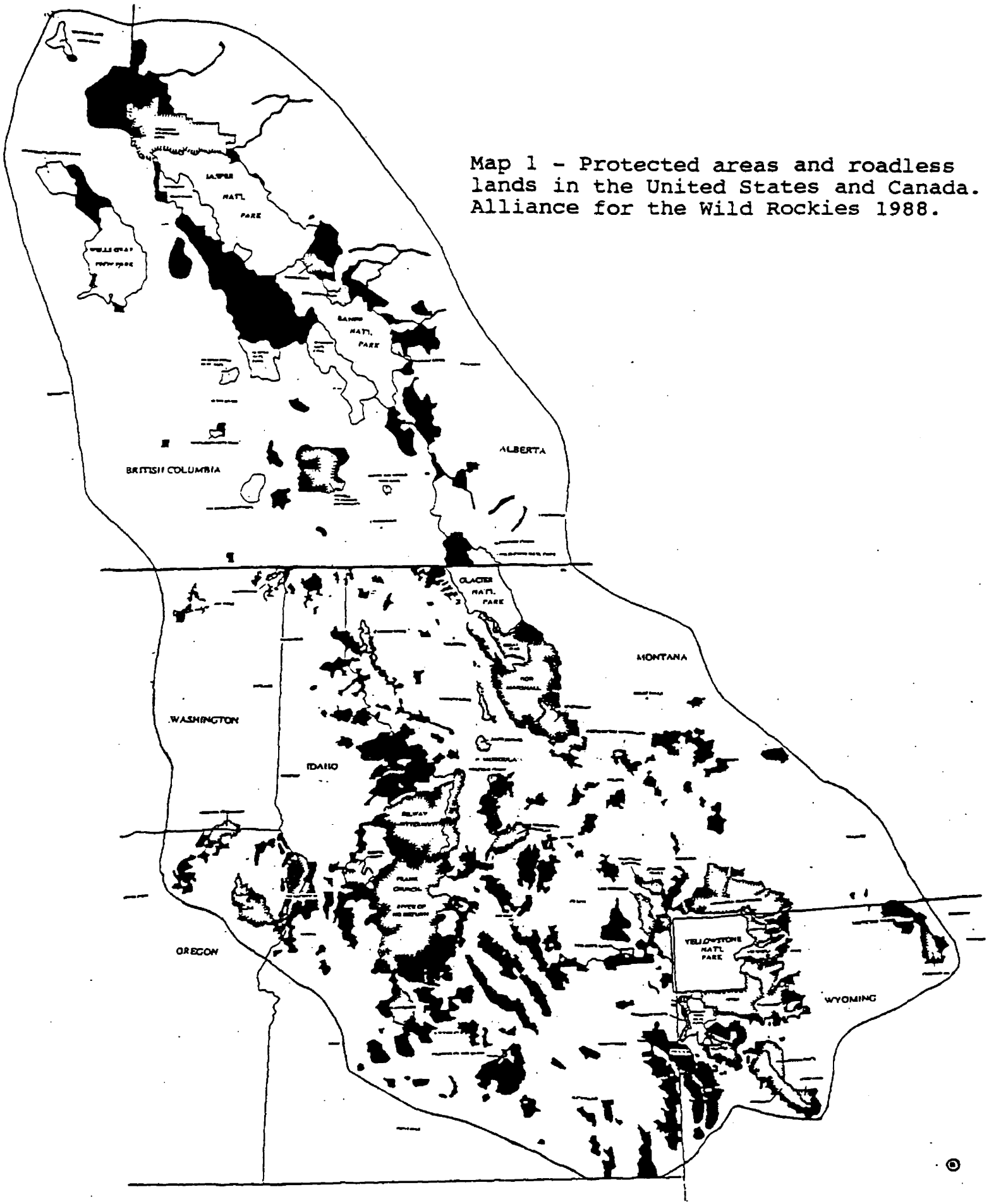
Introduction

Human degradation of biological systems has increased rapidly during the twentieth century, far outstripping the rate of natural change seen during recent millennia. This change is apparent across the globe, on every continent and in every ecosystem. As this century draws to a close, however, an increasing number of scientists, citizens and government representatives are attempting to curb the erosion of biological diversity and halt the unrestrained human behavior that threatens our fragile planet. One of the principal mechanisms for preventing the destruction of biological diversity is through the protection of representative ecosystems in reserve complexes. These reserves must be of sufficient size and variety to allow natural ecological processes to continue in the face of internal and external forces of change.

The idea of protection through the identification and design of nature reserve systems has been around for over a century, beginning in 1872 with the designation of the

Yellowstone region in the United States as the world's first national park. Yellowstone was set aside to prevent the destruction of the region's landscapes, wildlife and unique geological features from short-sighted development. Since the creation of Yellowstone National Park, thousands of parks, wilderness areas, and other biological reserves have been created around the world. The intent behind setting aside these areas has expanded considerably beyond preservation of scenic beauty to encompass the protection of biological diversity from the genetic to the landscape level.

In the Rocky Mountains of Canada and the United States, there is an opportunity to identify and protect significant areas of North America's remaining intact temperate ecosystems. But this process of protection needs to be driven by the best available biological knowledge, tempered by a realistic commitment to implement aggressive protection proposals once they have been prepared. This means forging a strong link between science and politics. Such a link must use the sophisticated models and perspective of conservation biology, driven by the political skill and knowledge of grassroots conservation activists working to protect the ecosystems of their home regions. This research paper will review approaches for effectively using both of these powerful tools in order to propose a protection strategy for the Rocky Mountains of British Columbia and Alberta, compatible and linked with existing reserve system proposals in Canada and the United States (see Map 1, next page).



Map 1 - Protected areas and roadless lands in the United States and Canada. Alliance for the Wild Rockies 1988.

Protecting Biological Diversity

Ecosystem reserve planning has become increasingly sophisticated throughout the world since the creation of Yellowstone National Park. Driving the ecological reserve planning process is the developing discipline of conservation biology, a branch of biological science concerned with the development of ecological theory and its application to the protection of biological diversity at all levels (Soule 1986). Conservation biology is rapidly gaining authority in the process of designing biological or ecosystem reserves as refuges for not only individual species of plants and animals, but for the processes of natural ecological function as well. Biologists are determining the minimum habitat requirements for numerous species' survival, and identifying the last remaining functioning land areas that may sustain intact species assemblages. Throughout the world, areas are being identified that retain sufficient size and natural function to sustain natural biological processes in perpetuity.

In the Earth's temperate regions, many biological systems have been fragmented and destroyed. Given the dense concentration of human population within the temperate band, it is becoming more difficult to identify areas where biological systems still function naturally. In North America, the western mountain region harbors a group of relatively intact ecosystem complexes. The Rocky Mountains of the United States and Canada contain large areas of remote

native forest, riparian, and alpine habitat. These areas are under intense pressure from human encroachment and face a severe threat of destructive development. Yet, in spite of the danger, there still remains an area large enough to support populations of the most wide-ranging and disturbance sensitive of the creatures in the Rockies, the grizzly bear (Allendorf, Harris & Metzgar 1991).

One of the principal problems facing designers of biological reserve systems is coping with the process of ecological change over the short- and long-term. All ecosystems change over time, but once a reserve has been established, its boundaries become static and lose their elasticity to compensate for changes in ecosystem structure and climate. Natural disturbances continually occur in all ecosystems, ranging in scale from tree fall gaps in a forest canopy to wildfires which consume hundreds of thousands of acres.

These disturbance events create a constantly changing mosaic of plant assemblages, which flow across the landscape over a period of years to centuries as disturbed areas recover through a natural progression of seral stages. Reserve system design must provide adequate area and species diversity to contain a full range of these short- to mid-term successional stages, in order that the system may absorb large and small disturbance events without the elimination of key species or habitats. This concept, "minimum dynamic area," indicates that for every ecosystem type there is a

minimum reserve size below which the scale of common disturbance events may exceed a critical maximum fraction of the reserve (Pickett & Thompson 1978). Exceeding this theoretical proportion effectively eliminates the intact function of the reserve in preserving ecological representation of all native species.

In addition to natural disturbance events, on the time scale of tens to thousands of years natural and human-induced climate changes introduce major unpredictable variables into the reserve design process. Plant assemblages have been modified by natural variation of global temperature cycles, notably during the recent period of continental glaciation and subsequent warming over the last 10,000 years (Schoonmaker & Foster 1991).

But in addition to natural perturbations in global temperature, the process of human-caused global warming resulting from the burning of fossil fuels and forests is increasingly effecting the Earth's climate (Peters & Lovejoy 1992). Although no accurate estimates of the rate or long-term effect of such changes are yet available, the impacts of rapid climate change are beginning to be felt and these impacts will have a measurable effect on the composition of species assemblages in North America (Hansen et al. 1987). As regional and global climates warm, species ranges will tend slowly to shift in latitude or elevation with the changing moisture and temperature regimes. Because species disperse at variable rates, major climatic changes will

result in new and unpredictable plant and animal assemblages, and species not able to disperse to more favorable habitats or adapt to formerly unfavorable conditions may face extinction (Huntley & Webb 1988).

The "greenhouse effect" has significant implications for the design of ecosystem reserve complexes. In addition to planning reserves of sufficient size to allow for disturbance events to be absorbed within the reserve boundaries, reserve design must also include a mechanism for species' range to shift with changing climate for response to natural population dispersal pressure. This mechanism has been identified by conservation biologists as a system of protected migration corridors or movement pathways which link reserve core areas to each other (Noss and Cooperrider 1994).

These corridors must be protected areas which connect the inviolate core reserves and maintain a pathway for the dispersal of genetic material between meta-populations of protected species. Based on the disturbance regimes and climate considerations facing reserve planners, a theoretical model for reserve system design has been developed by conservation biologists.

Ecosystem Reserve Design

A conservation biology-based plan must consist of four major components. First and foremost, large intact areas of the landscape possessing high levels of species diversity and wildlife habitat security must be identified and protected.

These areas tend to be large blocks of native habitat without road systems or permanent human disturbance (Noss & Harris 1986). Such areas form the core of the ecological reserve system (see Figure 1).

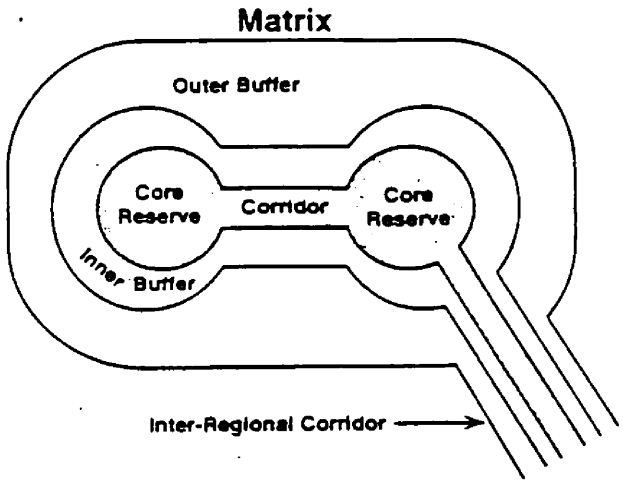


Figure 1 - Schematic model for ecosystem reserve design, using core reserves surrounded by buffer zones and connected by landscape linkages. From Noss 1993.

Connecting the core areas are corridors where disturbance activity is carefully prescribed to protect the native species within the corridor and limiting the level of disturbance that might inhibit the use of the corridor by migrating animal species. Corridors are identified using landscape features such as valley bottoms, ridge systems, major impediments to travel (large water bodies, steep alpine terrain, intensive human development), and documented evidence of historic migration use (Beier & Loe 1992).

Surrounding these core areas and corridors are buffer zones of land where some disturbance activity by humans is

permitted, but on a limited and carefully controlled basis. In the inner buffers, disturbances may be limited to non-motorized activities including sustainable forest practices, hunting, gathering of forest foods and products, human-powered recreation, and other activities which do not deplete or disrupt natural processes (Noss & Cooperrider 1994). Outer buffers provide a lower level of habitat security in order to permit more human disturbance. This may take the form of sustainable selective logging and intensive recreational developments.

Finally, the core/buffer system is set in a matrix of lands under private and public management. The matrix is composed of habitats where moderate to high levels of disturbance have taken place or are currently occurring. The matrix is managed to permit resource removal, but activity is controlled to prevent negative impacts to the buffer zones around core areas (Harris 1984).

It is critical to identify remaining areas which retain biological function and propose systems which protect them. The Rocky Mountain chain in North America presents an excellent opportunity to design and propose a system of ecological reserves based on the conservation biology model, and the current political climate presents the opportunity to implement such a system.

CHAPTER II

Contemporary Reserve Planning in the Rockies

Applying Reserve Design Models to the Rockies

Efforts are currently under way to identify and protect the remaining intact lands in the Rocky Mountains of the United States and Canada. Nearly every interest group in society acknowledges that many areas exist which deserve protection as parks and wilderness, but there is little agreement on an appropriate level of protection. Even the basic goals of reserve design are debated, varying from the protection of scenery and recreation, to preservation of representative samples of all ecosystem types, to the protection of biological diversity at the landscape level. Though consensus on the best approach has not formed, the majority agree that something must be done to protect the incredible biological wealth of the Rocky Mountains.

Reserve Planning in the United States

Most current protection proposals for the U.S. portion of the Rocky Mountains are focused on the extensive tracts of federal land administered by agencies of the United States government: the U.S. Forest Service, Bureau of Land

Management, National Park Service, and U.S. Fish and Wildlife Service. Historically in the U.S., protected areas have been established on a state by state basis using designations under the Wilderness Act of 1964 (16 U.S.C. §§1131-36). Additional areas may be protected in separate legislation as national parks (National Park Service Organic Act of 1916, 16 U.S.C. §§1-18f), wild and scenic rivers (Wild and Scenic Rivers Act of 1968, 16 U.S.C. §§1271-87) and through several other mechanisms.[1] However, it has become increasingly apparent that the piecemeal, state by state approach does not adequately protect landscapes, and that government sponsored protection plans too often omit critical areas because they contain valuable timber or mineral resources (Noss & Cooperrider 1994).

These conclusions have lead conservation groups and conservation biologists to join together in designing comprehensive ecosystem reserve plans that cross administrative boundaries to protect complete ecosystem assemblages. In particular, a growing movement initiated in the late 1980s under the loose direction of scientists and activists in conservation biology began the process of defining "greater ecosystems" spanning the North American continent (Grumbine 1990). This concept of landscape-level

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[1]Other major mechanisms for public land protection in the U.S. include the designation of reserves for scientific research under the National Forest Management Act of 1976 - 16 U.S.C. §§1600-14 (Research Natural Areas), the Federal Land Policy and Management Act of 1976 - 43 U.S.C. §§1701-84 (Areas of Critical Environmental Concern), and for protection of wildlife under the National Wildlife Refuge Administration Act of 1966 - 16 U.S.C. §§668dd-668ee (National Wildlife Refuges).

planning has been elaborated in scientific and popular literature and collected under the umbrella of The Wildlands Project (Noss 1992). The Wildlands Project advocates applying the techniques of reserve design from conservation biology to representative ecosystems throughout North America, and has identified a continent-wide complex of linked ecosystem reserves. But while The Wildlands Project largely remains an educational tool to illustrate and encourage the need for coordinated landscape-level reserve planning, the concept of ecosystem protection has been embraced by numerous local and regional activist organizations across the United States. These groups have begun preparing the proposals envisioned by conservation biologists.

One such plan, the Northern Rockies Ecosystem Protection Act (NREPA), has been advanced by conservationists from the five state northern Rockies region (Idaho, Montana, Oregon, Washington, and Wyoming) and endorsed by numerous scientists familiar with the species and ecosystem processes of the region (Bader 1991). This plan seeks to designate all remaining unfragmented and undeveloped roadless federal lands as core protected areas: wilderness, national parks, and wild and scenic rivers.

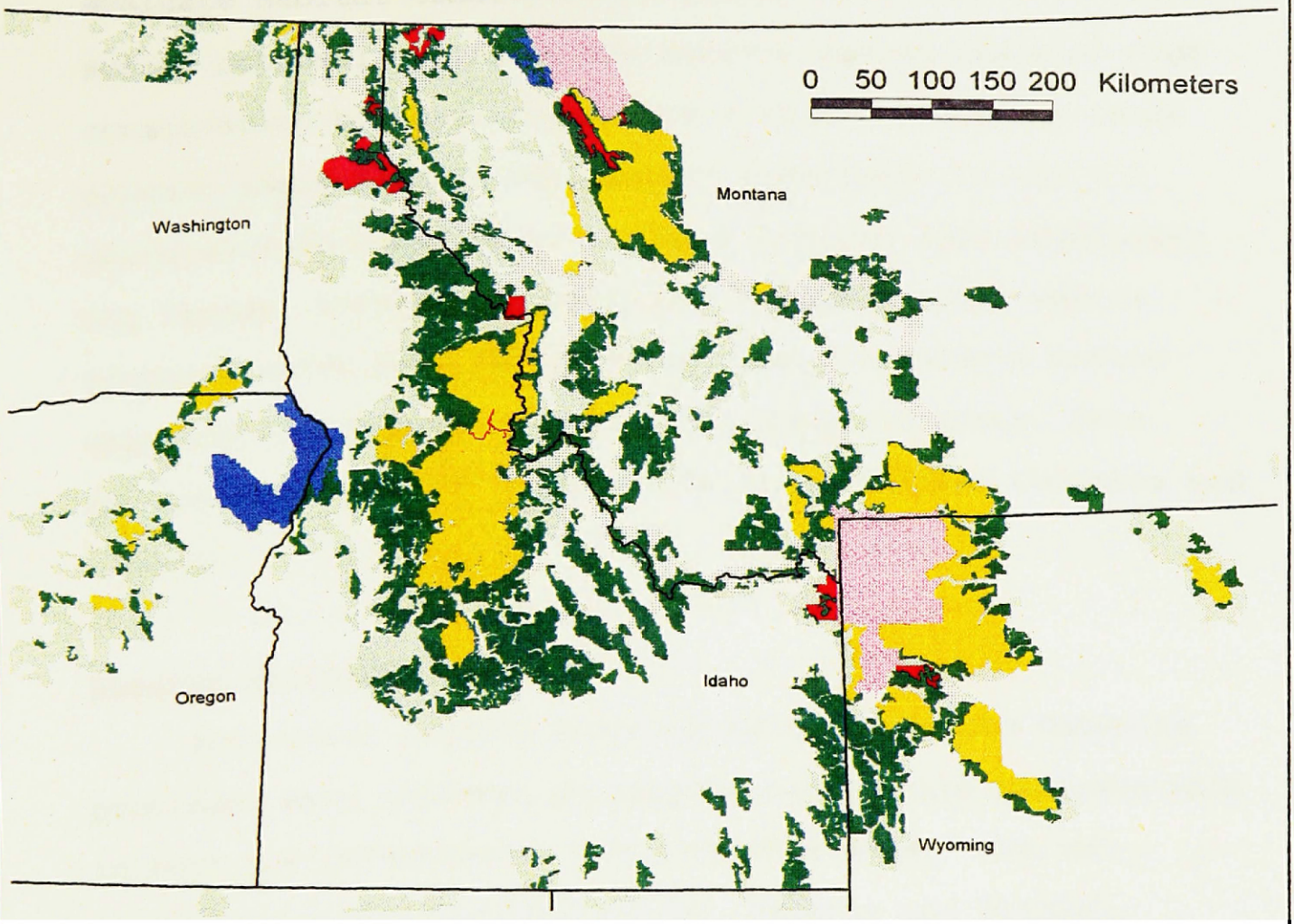
Areas in federal ownership which have already been damaged by resource extraction activities are protected in several different ways. NREPA has identified biological connecting corridors to serve as specially managed travel

ways, which will facilitate population exchange and genetic diffusion of wide-ranging species. It designates special management buffer zones surrounding core areas, where carefully controlled development may be permitted to occur. And it proposes wildland recovery projects for areas where development has severely damaged natural ecosystem function and restoration is essential to return lands and watersheds to some measure of their natural capacity. In all, some 20 million acres in the five state northern Rockies region are identified as necessary for ecosystem function and recovery under the NREPA proposal (see Map 2).

Although NREPA identifies key habitat in the United States for protection without regard to state and administrative boundaries, it does not reach across the 49th parallel into Canada. This results in serious problems for species protection planning in the U.S. The wildlands of British Columbia and Alberta are recognized as key source areas for recruitment of sensitive and endangered species individuals in the United States (Interagency Grizzly Bear Committee 1987). Yet, as wildlife populations in the U.S. decline and managers in federal and state agencies claim numbers will be replenished from Canada, the Canadian side of the border is being developed at a rate exceeding that in the U.S. (Horejsi 1989).

Essential to the protection of species and ecosystem function in the Rockies is a comprehensive reserve system

MAP 2. The Northern Rockies Ecosystem Protection Act



State Lines
Wilderness Designated by this Act
Wildland Recovery Areas
National Park Study Areas
National Parks
Existing Wilderness Areas
Biological Corridors
Developed and Roaded Federal Lands

Designations Made by the Northern Rockies Ecosystem Protection Act

Core Ecosystem Wilderness Areas:
10,436,893 acres

Biological Connecting Corridors:
a) Designation as Wilderness Areas:
4,560,983 acres
b) Designation as Corridor Management:
2,408,371 acres

Sky Island Wilderness:
1,289,712 acres

National Park and Preserve Study:
1,724,522 acres

Wildland Recovery Areas:
995,924 acres

Wild and Scenic Rivers:
1,301 miles

Study Rivers:
154 miles

Produced by The Ecology Center, Missoula, Montana by permission of the Alliance for the Wild Rockies.

plan that spans the U.S./Canadian border. Such a plan must evaluate habitat conditions in Canada and prepare a reserve system proposal utilizing the reserve design approach from conservation biology, compatible with and linked to lands already identified as key habitat components in the U.S. While no such comprehensive effort has yet been undertaken for Canada, several projects are currently under way or proposed which make useful steps toward a reserve system spanning the entire northern Rocky Mountain chain, from Yellowstone north to the Peace River in British Columbia and Alberta.

Reserve Planning in Canada

Ecological reserve planning projects in the Canadian provinces have advanced at varying paces, with progress made in both the governmental and private arenas. The two provinces relevant to this study, Alberta and British Columbia, have widely divergent track records for reserve protection. The World Wildlife Fund Canada, which tracks the efforts of Canadian provincial governments to protect undeveloped land, gave British Columbia a B+ on its conservation report card for 1994-95, the highest grade of any province, while Alberta received an F, which was the lowest (World Wildlife Fund Canada 1995).

Protected Area Planning in Alberta

Little success in conservation planning has been achieved in Alberta during the last two decades. No new large reserves have been designated in the province since 1977 (Hummel 1995). In 1992, the provincial government of Alberta endorsed the concept of protecting key reserves representing all ecological classifications in the province. This endorsement was accompanied by a draft of Alberta's reserve system plan, *Special Places 2000: Alberta's Natural Heritage*. The draft plan received strong public support from 80% of Albertans, who favored immediate implementation of *Special Places 2000*, but the plan met aggressive resistance from industry and "wise-use" groups.

In 1995, *Special Places 2000* was released in final form for public review, with significant areas deleted from the plan and protection for remaining preserves weakened (Hummel 1995). Because of the changes, conservationists opposed the plan and no progress has been made on implementation although the province has claimed that it will designate final reserve system elements by 1997 (World Wildlife Fund Canada 1995).

In 1990, the Alberta Wilderness Association proposed a system of reserves called *A Protected Areas Agenda for Alberta* which identified key areas as parks, ecological reserves, wilderness areas, recreation areas and heritage rivers (Alberta Wilderness Association 1990). This agenda is currently inactive as the provincial planning process moves forward.

Protected Area Planning in British Columbia

In contrast to Alberta, the government and citizens of British Columbia have made significant efforts to identify lands under federal and provincial control which merit protection. Because of the disparity in planning progress between Alberta and British Columbia, this review will focus on the process in British Columbia. There, the efforts by government and private conservation organizations have generated clear agendas and have produced several different planning initiatives.

In general, the government of British Columbia is proposing reserve designations as part of a larger land-use planning process for sustainable development, while most conservationists are pressing for or preparing biological reserve plans to protect biological diversity using the reserve model from conservation biology.

Summarizing these initiatives and the plans they produce will provide a perspective valuable to the planning process proposed by conservationists in the northern Rockies. Comparing the reserve system proposals of the government with those of conservation groups, in light of the tenets of conservation biology and practicalities of politics, will help activists to develop a proposal for a Canadian Rockies reserve plan complementary to NREPA.

Planning by British Columbia Government

In the late 1980s, the British Columbia government began to identify key areas of disagreement between industry groups and conservation organizations, in order to define the future scope of conservation planning (Hummel 1995). This analysis was initiated by the highly contentious public dialog over the logging of old-growth forests, and resulted in a series of old-growth management planning sessions in 1989. From these sessions science, government and citizen planning teams produced a series of reports on old-growth forest resources in British Columbia, the *Old Growth Strategy,* to guide the development of Land and Resource Management Plan old-growth standards through the end of the 1990s (British Columbia Ministry of Forests 1992).

But through the *Old Growth Strategy* process, it became apparent that a concentrated planning effort would be required to establish a system of protected lands. The government concluded that only through the final designation of reserves could the rest of the province be zoned open to resource development (British Columbia Protected Areas Strategy 1993). The *Old Growth Strategy* became the first major component of the provincial *Protected Areas Strategy* (PAS) planning process.

British Columbia Protected Areas Strategy

The focus on dwindling old-growth and the intense political pressure to protect intact native forest watersheds

encouraged the British Columbia government to undertake a province-wide initiative to delineate areas for inclusion in an expanded park and wilderness reserve system. Using the conservation findings of the Brundtland commission report on sustainable development as a starting point for the size of a reserve system (World Commission on Environment and Development 1987),[2] the British Columbia government started work on the *Protected Areas Strategy* for the province in January, 1992. Using the Brundtland report findings as a basis, the PAS set as its goal the protection of 12% of the land base in a reserve system by the year 2000 (British Columbia Protected Areas Strategy 1993).

The PAS process mandated that the government identify reserve candidate areas based on an interagency review of lands under provincial control. Planning was begun by the two agencies which administer the majority of provincial public lands, the British Columbia Forest Service and British

---

[2]In 1983, the United Nations created the World Commission on Environment and Development, chaired by Gro Harlem Brundtland of Norway. This commission prepared an exhaustive analysis of the global prospects for "sustainable development" and published these findings in the book *Our Common Future* in 1987.

As a part of these findings, the commission evaluated the adequacy of existing ecological reserve networks in protecting biological diversity. Their estimate was that "nearly 4 per cent of the Earth's land area is managed explicitly to conserve species and ecosystems" (p. 147) but that while globally reserves had expanded by 80% since 1970, "a consensus of professional opinion suggests that the total expanse of protected areas needs to be at least tripled if it is to constitute a representative sample of Earth's ecosystems" (p. 166-67).

This statement has been taken as offering the magic number of 12% for protected areas by supporters of the Brundtland Report's findings, among them Canada. The 12% number was lent further credence and momentum by the World Wildlife Fund Canada's decision to press for a minimum of 12% of Canada's ecological land classes to be protected under their Endangered Spaces Campaign. While WWF has attempted to stress that 12% is a minimum figure, the effect has been for the government to use it as a ceiling.

Columbia Parks. These agencies inventoried lands under their jurisdiction, prepared draft maps of wilderness areas and lands with important recreational and cultural features, and circulated the maps for public comment. After public review, the two plans were combined to create the *Parks and Wilderness for the 90s* program (Province of British Columbia 1992) which became the second major component of the PAS project (see Map 3).

Fundamental to the PAS approach was the comprehensive representation of at least 12% of each ecological land classification in the province within the reserve area system.[3] No more than 12% of the province was to be considered in study areas at any one time, and combined with existing reserves (slightly more that six percent of the province) a total of 18% was the maximum amount of land to be in protected areas or study areas during the planning process. When the PAS process finished its deliberations, approximately 12% of the province would remain in protected areas distributed across all representative ecosections (British Columbia Protected Areas Strategy 1993).

Although the PAS program included a process for designating reserves, the British Columbia government created a separate planning process to develop regional land-use plans for expanding the reserve system while simultaneously

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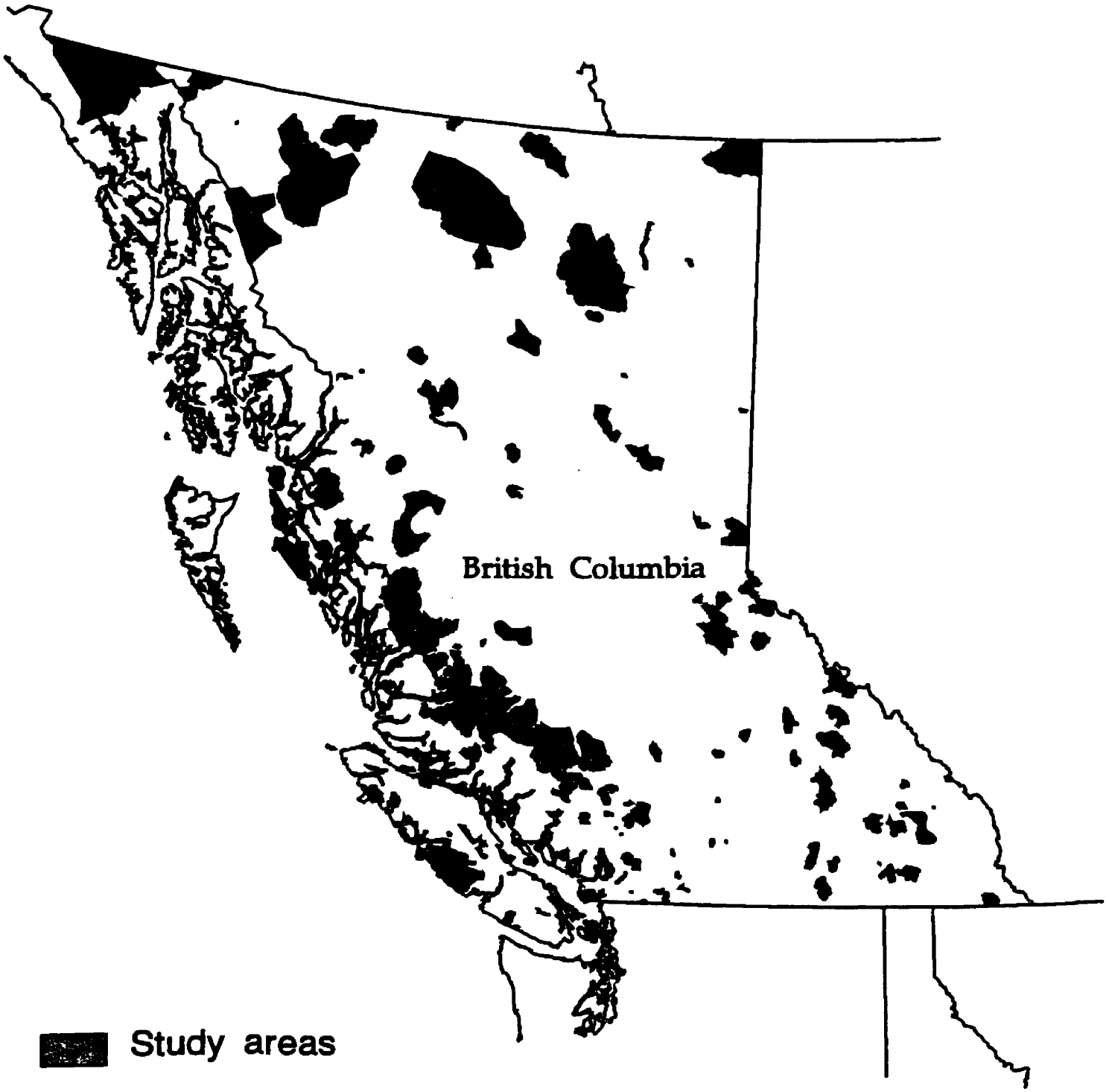
[3]The Ecoregion classification system has been developed by the Canadian Council on Ecological Areas. Beginning in 1991, the CCEA has been delineating Canada by region based on landform and climate features. The Ecoregion system is further broken down into Ecosections. British Columbia has 110 Ecosections, while Alberta has 20.

Map 3 - Protected area strategy study area boundaries.
From British Columbia Land Use Coordination Office 1996.



releasing all other public lands into various development prescriptions. Incorporating input from representatives of government agencies, industry, and the public, planners were to evaluate land-use conditions and planning needs in the province and propose a plan for meeting the protected areas goal while ensuring continued industrial uses and employment.

The Commission on Resources and Environment

This land-use planning process began with the creation of the Commission on Resources and Environment (CORE) in July of 1992 (Province of British Columbia 1992). Since its inception, CORE has produced land-use plans for four regions of British Columbia: Vancouver Island, Cariboo-Chilcotin, West Kootenay-Boundary, and East Kootenay (see Map 4).

Map 4 - CORE land-use planning areas. From Province of British Columbia 1995a.

Two of the plans, West Kootenay-Boundary and East Kootenay, encompass a significant portion of the Rocky Mountain chain's western slope and therefore are of particular interest to planning a reserve system for the Rockies' region. The CORE land-use plans do not fully implement the PAS reserve system, since PAS system was province-wide while the CORE plans focus on specific regions within British Columbia. Review of the PAS/CORE process illustrates why merging the two initiatives has weakened the drive to create a comprehensive protected areas system for the province.

The PAS/CORE Planning Process

The PAS process was specifically designed to identify areas for inclusion in the protected areas system, and directed government agencies and scientists to designate lands for protection based on their ecological and cultural value. Using the goal of protecting 12% of the province along ecosection boundaries, the two selection criteria for study areas were that (1) the system protect viable, representative samples of the major terrestrial, marine, and freshwater ecosystems along with the landforms, hydrology, recreational and cultural features of each ecosection, and (2) that the system protect special and rare features, including cultural, ecological, geological and recreational sites (British Columbia Protected Areas Strategy 1993).

The PAS was organized using staff from provincial government ministries including: Environment, Lands and Parks; Forests; Energy, Mines and Petroleum Resources; Aboriginal Affairs; Tourism and Culture; Agriculture, Fisheries and Food; and Economic Development, Small Business and Trade. These representatives were organized into a bureaucratic hierarchy for developing and implementing the PAS:

> Regional committees are the key government players. Implementation of the Strategy will occur at the regional level through the Inter-agency Management Committees and the regional and sub-regional land use planning processes.
>
> • Regional Protected Areas Teams (RPATs) are responsible for conducting the technical inventories and analyses required to identify gaps in the protected areas system, identify areas of interest, consult with the public and propose study areas.
>
> • Inter-agency Management Committees (IAMCs) in each region are responsible for integrating all resource planning and protected areas work in a region, and for setting regional priorities. These senior managers consider potential social and economic implications of proposed study areas, make recommendations on study areas to the Assistant Deputy Ministers' Committee, and propose and implement Interim Management Guidelines for study areas.
>
> • The Protected Areas Coordinating Team (PACT) provides provincial-level analysis of critical issues, policy interpretation, and coordination between regions, as well as ensuring that provincial standards are maintained.
>
> • The Assistant Deputy Ministers' Committee is responsible for developing the Strategy and overseeing its implementation. It reports to the Cabinet Committee on Sustainable Development.
>
> • Cabinet is responsible for approving the study areas and for determining which study areas should be formally designated for protection. (British Columbia Protected Areas Strategy 1993.)

The PAS mandate to identify lands for a reserve system was accompanied by the explicit release of all other provincial lands to the Integrated Resource Management Lands

category. Integrated Resource Management Lands (IRML) were defined as "Areas where the principles of integrated resource management apply to all resource use, such that the quality and biological productivity of the resource is maintained while the needs of a wide range of resource users are accommodated" (PAS 1993). This was further defined to read that "All integrated resource management lands are to be open to resource development. .... On some lands, the emphasis may be on commercial or industrial activities; in others, commercial and industrial activities may be maintained even though the emphasis is on conservation, cultural heritage protection or recreation" (PAS 1993).

While the PAS worked to ensure the protection of lands with high ecological and cultural value, the other major reason for its existence was to facilitate the release of all other lands (some 88% of the province) to development in order to ensure "a stable, sustainable economy" (British Columbia Protected Areas Strategy 1993).

Using the *Old Growth Strategy* and *Parks and Wilderness for the 90s*, the PAS process identified a province-wide selection of lands considered essential to a complete expanded reserve system. The reserve implementation schedule was originally established by the *Parks & Wilderness for the 90s* program in 1992. This schedule placed reserves in four establishment priority categories: Category 1 included lands eligible for immediate designation, based on extensive land-use analyses already completed; Category 2 lands were

deferred until 1993 while planning details such as reserve boundaries and legal disputes were finalized; Category 3 lands were deferred until 1995 while land-use planning was implemented or completed for the region and boundaries/disputes were settled; and Category 4 lands were deferred until 2000, either because land-use planning had not yet begun, their conservation value was not as high as other areas, or because resource conflicts were not deemed likely in the interim (British Columbia Ministry of Forests & British Columbia Parks 1992).

However, instead of proceeding with the PAS designation process that was originally envisioned, the provincial government elected to create a special land-use planning process under the Commissioner on Resources and Environment Act of 1992 (Province of British Columbia 1992). This Act created the Commission on Resources and Environment, empowered to undertake comprehensive land-use planning for all regions in the province including the lands designated as reserve study areas by the PAS. The process was to consider ecological and economic sustainability, along with aboriginal interests, using a consensus process of regional round table meetings.

The CORE process added a significant degree of complexity to the process of designating ecological reserves. In addition to the problems of settling the differences between industry and environmentalists over which 12% of the landscape to protect as parks and wilderness under the PAS,

the CORE process added the problem of deciding how to maintain the economic stability of communities affected by the reserve designation process. This entailed an elaborate study process evaluating economic trends in primary industries such as logging, mining, and agriculture, as well as developing projections of economic trends in the secondary sector areas of outdoor recreation, service business and government. Additionally, regional population trends were evaluated, urban and rural exchange patterns studied, unemployment projections generated, and job creation under different scenarios considered (Province of British Columbia 1992).

The planning process under the Commission on Resources and Environment is largely complete. The CORE land-use tables for the Kootenays produced hundreds of pages of documents detailing numerous factors including resource economics, community stability, ecological sustainability and First Nations participation. While these factors all bear on the land-use planning process, this review of the CORE process will be limited to the protected area land-use designation process. The *Old Growth Strategy* and PAS only peripherally considered economic and social factors, and the plans advanced by conservation organizations were not able to evaluate such factors at all. Thus, limiting this review to ecological planning criteria focuses the discussion on evaluation factors shared by all planning efforts.

The protected area designations and resource development land-use plans under CORE were completed in 1995, officially ending the PAS process for the Kootenays. While additional planning efforts to determine the potential of Special Management Areas to serve as linkage corridors continue for portions of the Kootenay region, the CORE protected area reserve system is now in place.

The Kootenay Land-use Plans

The CORE initially identified the Kootenay region as a single planning area. However, it soon became apparent to planning groups that the Kootenay region was ecologically, socially and economically complex enough to warrant separating the area into two units (Province of British Columbia 1992). These units, the West Kootenay-Boundary and East Kootenay planning areas, are located in the southeastern portion of British Columbia in the Columbia Mountains and west slope of the Rocky Mountains and overlap exactly the boundaries of the Nelson Forest Region of the British Columbia Forest Service.

The CORE developed several evaluation criteria to guide the Protected Areas designation process. Criteria similar to those used in the PAS process were used to develop the reserve units in the Kootenay plans, but differed with the additional inclusion of social and economic planning factors. The Kootenay planning tables assessed protected area values based on:

> Representation: The extent of regional representation by ecosection and biogeoclimatic subzone variant required to support wildlife, fish and naturally occurring vegetation.
>
> Naturalness: The degree of human disturbance resulting from resource exploration and extraction, facility development and roadbuilding.
>
> Biodiversity: The number and diversity of species supported by an area, the extent to which species are rare, threatened or endangered, and the amount of critical habitat contained within an area.
>
> Recreation Value: The significance of the recreation amenities and features contained within an area, the benefit of protecting these amenities from resource development, and the level of current and potential recreation use provided by an area.
>
> Cultural Value: The existence of First Nation cultural and heritage sites and places of spiritual importance, the existence, quality and significance of post-contact sites in accordance with representative themes (e.g., early settlement, mining, forestry, transportation, etc.) and the existence of special cultural/heritage features (e.g., historic trails).
>
> Other considerations in the selection process were socioeconomic costs associated with restricting development activity in Protected Areas, the viability of Protected Areas in terms of being large enough to achieve conservation objectives, and the balance between provincial, regional and local interests. (Province of British Columbia 1995a.)

Both of the Kootenay areas used the same planning criteria for the development of their management guidelines. The basic process for assessing land-use designations within the planning areas was the creation of a consensus-based planning table composed of representative public and government interest sectors from the region. Selections from regional interest groups placed 21 representatives at the planning table in East Kootenay and 22 sector representatives at the West Kootenay-Boundary table. These interest sectors then participated in developing land-use scenarios and testing these scenarios against a base case of no further

planning, to see how effectively different plans addressed different sector interests. An impact analysis system was developed to measure the impacts of the various land-use scenarios.

Since the Kootenay tables comprised sectors of the public representing environmental, economic and social interests, the CORE used an issue identification system utilizing the interest statements prepared by each of the participating sectors in order to address conflicting interests. These interest statements served as a basis for preparing sector goals and for defining indicators to measure how effectively goals were being met under various land-use scenarios. To provide the information necessary for decision-making, government support teams were established with representation from all ministries with responsibility for resource management.

The government support teams provided research and technical information to assist sectors in identifying and communicating their interests and priorities with respect to land-use and resource and environmental management. Using geographic information system (GIS) computer technology, the government support teams helped sectors to develop maps showing the location of high-value resource areas important to each sector.

The government support teams also assisted sectors in refining their goals and measurement indicator criteria into key "issue accounts." Issue accounts were broken into major

sections and subsections for analysis, including: biodiversity, landscape and regional connectivity, riparian habitats, fisheries, ungulate winter range, furbearer habitat, grizzly bears, woodland caribou, protected areas and ecological representation, forestry, timber volume calculations, employment and income impact calculations, forest industry transition initiatives, mining, livestock grazing, tourism, community and social impacts, non-motorized and motorized recreation, heritage resources, and First Nations concerns.

Using these issue account analyses as the basis for their consensus-based land-use designation process, the interest sectors reviewed resource data maps of the planning regions in order to assign lands different resource use designations. The planning tables evaluated subregions within the planning areas with the goal of assigning each planning unit one of the following land-use designations:

> Dedicated Use Areas: The Dedicated Use designation identifies land where significant industrial investment and resource enhancement opportunities exist. Some of these areas are suitable for maximizing short- and long-term timber volume and quality through intensive forest management. Other areas may provide specific opportunities for development associated with coal mining, hard-rock mining, oil and gas exploration and hydroelectric development. Within Dedicated Use Areas, the key fish and wildlife habitats, sensitive landscapes and opportunities for other resource users will be maintained in accordance with the provisions of the Forest Practices Code and related policy and legislation.
>
> Integrated Use Areas: The Integrated Use designation provides opportunities for a full range of resource values. Management emphasis may vary within a particular land unit according to the distribution, availability and sensitivity of resource values. This means that within Integrated Use Areas, certain portions may be managed as intensive resource areas, in accordance with high-value resource inventories, or as Special Management Areas in accordance with sensitive viewscapes, recreational features,

> domestic watersheds, wildlife habitats or environmental features.
>
> Special Management Areas: The Special Management designation is applied in areas where there is a concentration of special values such as fish and wildlife habitat, biodiversity corridors, viewscapes, cultural and heritage values, back-country recreation and community watersheds. This designation is also applied to areas adjacent to Protected Areas that provide support for sensitive Protected Area values. All types of resource development are permitted in Special Management Areas as long as they are compatible with identified special values. Management objectives and guidelines are to be developed for each Special Management Area to reflect its particular special values and features. This means that a generic set of management specifications does not exist for this designation.
>
> Protected Areas: The Protected designation is consistent with the Protected Areas Strategy, which provides for a range of protection options, from strict preservation to intensive recreation and tourism. All uses permitted under the Protected Areas Strategy, including grazing, hunting, fishing and commercial tourism, will be acceptable unless otherwise specified in this plan or in management plans for existing Protected Areas. (Province of British Columbia 1995a.)

The boundaries for the land-use designations were developed at a 1:250,000 planning scale which, while deemed appropriate for regional planning purposes, did not permit the precise location of boundaries. Thus, the agencies responsible for plan implementation anticipated that boundary review and refinement would be required at a more detailed scale before exact areas and designations would be finalized.

In the case of the East Kootenay table, sector consensus was reached on some 85% of planning units within the region, and the table was able to transmit a preliminary land-use map to the Commissioner on Resources and Environment for completion. The West Kootenay-Boundary table only reached agreement on 45% of its units, and did not present a land-use map to the Commissioner. The multi-party sector process

guaranteed that all consensus decisions would be included in the final land-use plans produced by the government, while areas lacking consensus would be assigned final designations by the Commissioner. After the sector interest tables presented their findings, the Commissioner prepared final land-use maps and assigned management designations.

Land-use Designations for the East Kootenay Region

The East Kootenay planning process extended from January 1993 to July 1994, during which time the table met 18 times for a total of 44 days. Public meetings were held throughout the region to provide an opportunity for interested parties to participate in the process. The East Kootenay region covers 4,067,455 hectares of land. In order to negotiate land-use designations and management guidelines, the area was divided into 137 units, known as land-use polygons. The table reached consensus designations for 116 of these polygons, leaving the remainder to the Commissioner for designation. Polygons were generally defined by some ecological feature such as a watershed or habitat area.

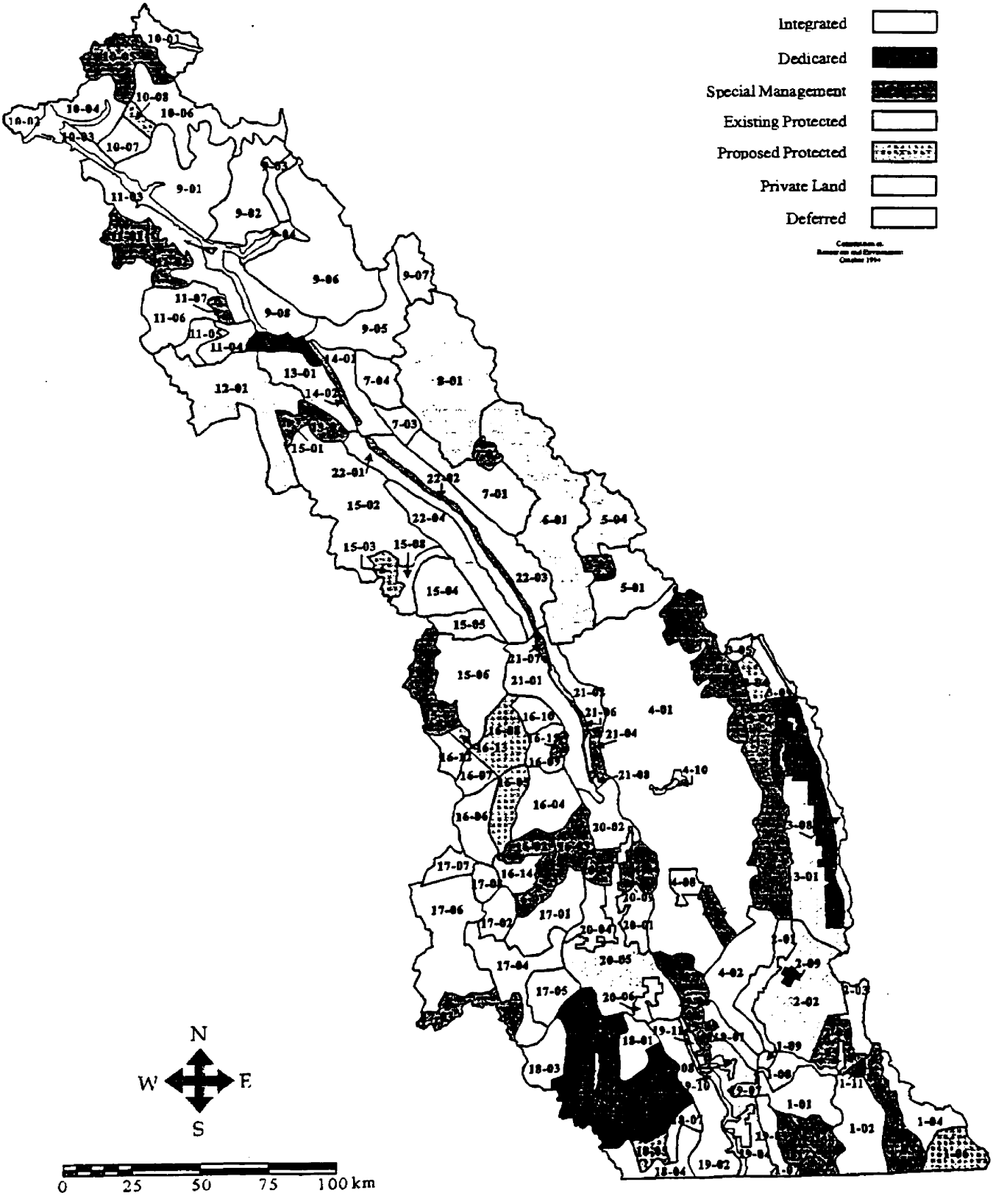
Of the total land area, 535,165 hectares, or 13.1 percent, was already managed in protected areas (federal or provincial parks, and ecological reserves). Some 369,951 hectares, or 9.1 percent of the East Kootenay region, is private land. While the CORE land-use planning process did not apply to private land, it acknowledged there would likely be cases where Crown resource management objectives were

affected by neighboring private landholdings. Examples included private lands which support key wildlife populations, that possessed important visual qualities or were located in or adjacent to Protected Areas. The CORE plans retained the option to negotiate with private landholders to purchase or exchange lands as a means of resolving public use and private use resource conflicts.

The land-use recommendations for the East Kootenay plan focused on the remaining 77.8 percent of the land base not already protected or privately held. In the East Kootenay, approximately 3.2 million hectares of land is managed by the province for a broad range of resource multiple uses. The plan proposed the following designations (see Map 5 & Appendix I):

- Six new Protected Areas, totaling 116,298 hectares. These new areas amount to 2.9 percent of the land base, which brings the total amount of protected areas for the region to 651,463 hectares, or 16 percent.
- Twenty-eight areas, totaling 499,546 hectares, as Special Management Areas, amounting to 12.3 percent of the regional land base. These areas are notable for containing concentrations of resource values that require special management, such as biodiversity, support zones for Protected Areas, recreation and domestic watersheds. Human use and extractive development activities will continue in a manner that is compatible with the objectives and guidelines identified for these areas, that emphasize the maintenance of the sensitive resource values located in such areas.
- Six areas in the East Kootenay region have been proposed as Dedicated Use Areas, comprising 200,438 hectares or 4.9 percent of the regional land base. The management emphasis is on resource use and development while ensuring the maintenance of basic environmental quality. It is recommended that a regional forestry task force advise on possible additional areas for this designation.
- One area - the lower Cummins River, totaling 14,769 hectares or 0.4 percent of the regional land base - has been proposed

Map 5 - East Kootenay region land-use designations by polygon. From Province of British Columbia 1995b.



as a Deferred Area. This is a temporary designation that allows for additional planning and review at a local level to determine an appropriate permanent designation. ....

- Integrated Use Areas, totaling 2,331,159 hectares, make up the remaining 57.3 percent of the East Kootenay region's land base. These areas support multiple resource use and are guided by the principles of responsible resource stewardship provided in the Forest Practices Code and other land use policies. (Province of British Columbia 1995b.)

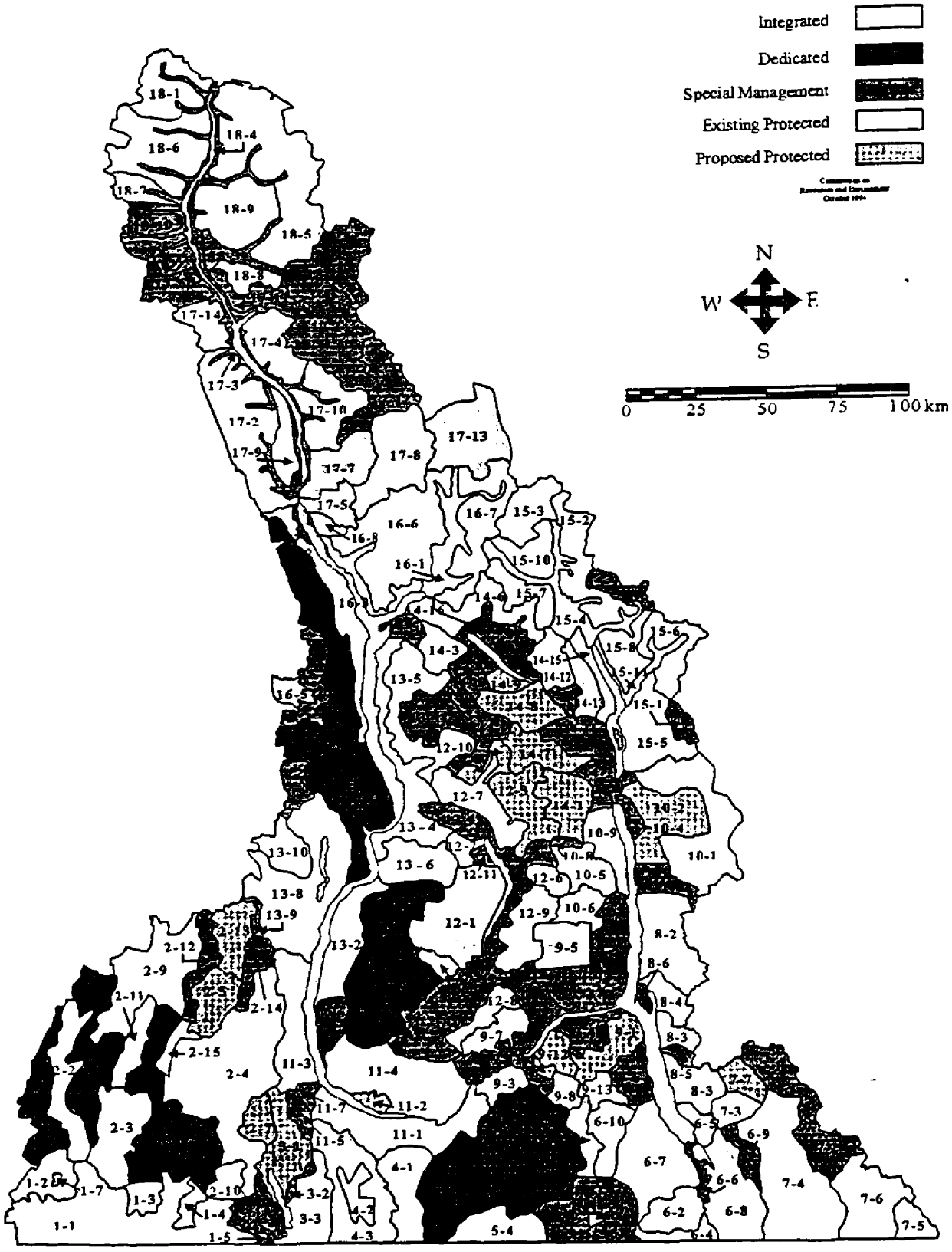
Land-use Designations for the West Kootenay-Boundary Region

The West Kootenay-Boundary planning process also extended from January 1993 to July 1994. During this period, the table met 24 times for a total of 48 days, with meetings throughout the region open to the public. The land area of the West Kootenay-Boundary region is 4,167,583 hectares, with about 9.9 percent of the land in the region privately owned. The planning table divided the region into 163 land-use polygons, with consensus designations reached for only 73 of the total.

Prior to the CORE process 215,399 hectares, or 5.2 percent of the region, was managed as fully protected federal or provincial parks and ecological reserves. CORE's land-use planning recommendations directed that the remaining Crown lands be placed in the following categories (see Map 6 & Appendix II):

- Eight new Protected Areas, totaling 256,235 hectares. These new areas amount to 6.1 percent of the land base, which brings the total amount of protected area for the region to 471,634 hectares, or 11.3 percent.
- Thirty-six areas, totaling 785,257 hectares, are proposed as Special Management Areas, amounting to 18.9 percent of the regional land base. These areas are notable for containing features that require special management, such as biodiversity, support zones for Protected Areas, recreation and domestic watersheds. Human use and extractive

Map 6 - West Kootenay-Boundary region land-use designations by polygon. From Province of British Columbia 1995c.



development activities will continue in a manner that is compatible with the special features identified.

- Integrated Use Areas, totaling 2,107,294 hectares, or 50.6 percent of the land base of the region. The management intent in these areas is to maintain the long-term health and productivity of the land base and to provide a variety of opportunities for sustainable resource use.
- Eight areas in the region have been proposed as Dedicated Use Areas, comprising 380,799 hectares and 9.1 percent of the regional land base. The management emphasis is on resource use and development while ensuring the maintenance of basic environmental quality. (Province of British Columbia 1995c.)

Implementing the Land-use Plans

These land-use plans, after their public release in 1995, were presented to the provincial government for review and approval. After the protected areas were approved by the Cabinet, the plans were returned to the provincial government for implementation. Implementation requires coordination among government agencies in order to ensure that plan recommendations are incorporated into provincial land management policy.

The Land Use Coordination Office (LUCO) is responsible for coordination and integration at the provincial level, and inter-agency management committees (IAMC) assume similar responsibility at the regional level. In order to establish a linkage between the regional and site-specific plans, management guidelines defining each area's critical resource values will be developed and translated into measurable objectives or prescriptions (see Figure 2, next page).

The assumptions underlying the impact assessment component of the land-use plans provided a starting point for generation of the guidelines. Once developed, these

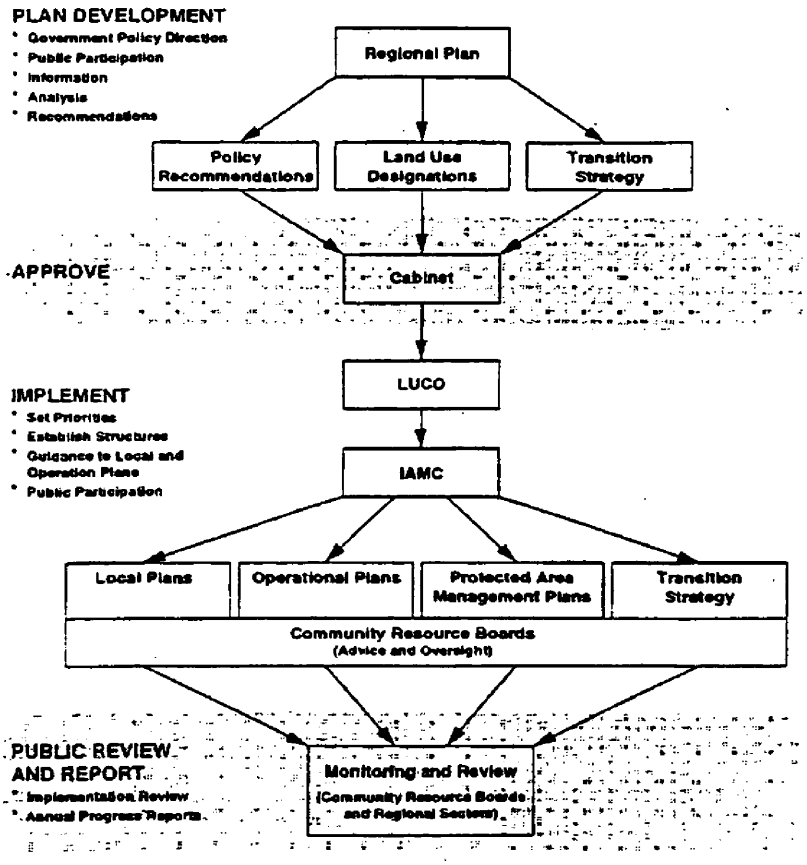


Figure 2 - Flow chart of implementation process for CORE land-use plans. From Province of British Columbia 1995b.

prescriptions will be integrated with the requirements of British Columbia's Forest Practices Code to facilitate implementation of both the Plan and the Code.

One component of the Plan that is especially critical in terms of coordination among government agencies is the development of management plans for Special Management

Areas. These areas contain a range of sensitive values which prevented their inclusion into the Integrated or Dedicated use categories. For example, a timber cutting plan in a Special Management Area with high values identified for wildlife, ecology, tourism and recreation must be jointly approved by the ministries of Forests, Environment, Lands and Parks, and Small Business, Tourism and Culture. Special Management Areas are currently being reviewed for their value as corridor zones connecting recently designated or previously protected areas within the Kootenay planning area and the surrounding region.

Problems with PAS/CORE

Although the British Columbia government invested considerable time and bureaucratic effort in identifying lands for protection, these efforts may not adequately protect biological diversity across the landscape. The government land-use plans do not offer any biological evidence that the areas identified will be adequate in size or connectivity to sustain individual species or natural ecosystem processes, or that they will be protected in perpetuity. While the planning process attempted to base decision-making on quantitative criteria, the CORE acknowledged that problems existed with the evaluation process:

> Evaluation of regional land use designations at the regional level is extremely challenging. Like the regional land use designations themselves, their evaluation is inherently general and approximate - specific implications are hard to identify.

> There are a number of reasons for this, many of which are a function of the regional planning scale; nonetheless, evaluation is an essential part of any planning process because it provides an indication of how well a particular plan will contribute to the diverse and competing goals in society. Knowledge of the pros and cons of a plan, as exposed through the evaluation process, provides a foundation for political judgment on whether or not a Plan should be implemented.
>
> There is one main difficulty in plan evaluation: some benefits and costs can be readily quantified on the basis of resource inventories and known relationships, while others cannot. For example, a plan's implications for total timber volume or employment impact can be expressed numerically with a fair degree of accuracy; on the other hand, its contribution to the conservation of biodiversity, or the extent to which it satisfies tourism objectives, is necessarily expressed in more qualitative and subjective terms. This means that decisions to act upon a given set of land use plan recommendations are "on balance" decisions - judgments that must be taken following a synthesis of various and complex pieces of information. (Province of British Columbia 1995a.)

Using the arbitrary 12% figure for the maximum size of a reserve system raises serious questions about the biological validity of the PAS/CORE planning process, and the failure to identify connecting corridors linking reserves illustrates the lack of a current scientific basis for the CORE land-use plans. While the CORE process is now examining the possible recognition of connecting corridors, this process at best will result in the attachment of additional management guidelines to the Special Management Areas under the CORE land-use plans and Forest Practices Code. While Special Management Areas compose some 15% of the Kootenay area, they are specifically dedicated to "the full range of resource use" albeit with the caveat that development occur "in a way that respects sensitive natural and cultural values" (Province of British Columbia 1995a). It remains to be seen

how comprehensive and effective the protection of corridors and buffers may be under the CORE plans.

Another significant problem with the CORE is that the government held exclusive control over who sat at the table in the multi-stakeholder process. The British Columbia government's use of a round table approach involving land management agencies, industry representatives, environmental organizations, and the general public presented great difficulties for reaching consensus on key resource questions. The CORE tables screened from public view the give-and-take process of reaching a result in the negotiations. The tables produced reports representing the consensus of the participants and the interests of the government. The reasons for particular decisions were not given, which disguises the essentially political nature of the process. The winners and losers in the process and the concessions made are not revealed in the final land-use plans. The CORE process produced a complex plan but failed to provide an explanation for the plan's provisions.

Reserve Planning by Canadian Conservationists

The government reserve planning process has been paralleled by efforts on the part of conservation organizations in Canada and the United States to develop their own land protection schemes for British Columbia. Numerous groups have proposed area by area protection plans, often focused on individual valleys or watershed complexes.

These groups have met with some success in protecting important elements of the landscape, but only recently have they turned toward preparing comprehensive ecosystem reserve plans (Hummel 1995). Several efforts are under way to identify large connected blocks of ecologically intact land for protection in reserve complexes.

Large, nationally prominent environmental organizations such as the Canadian Parks and Wilderness Society (CPAWS) and the World Wildlife Fund (WWF) Canada are working with regional groups in British Columbia to identify coordinated planning approaches. The two major regional or province-wide planning approaches in British Columbia are the Canadian Endangered Spaces campaign organized by the WWF in 1989, and the nascent Yellowstone to Yukon campaign (a joint effort by CPAWS, WWF and The Wildlands Project), a proposal to develop a conservation plan for the entire Rocky Mountain chain (Hummel 1995).

The WWF Canada has been deeply involved with conservation planning at the federal and provincial levels with their Endangered Spaces Campaign (Hummel 1995). This effort was initiated to take advantage of the Brundtland report's popularity with Canadian government, and has worked to support the 12% reserve solution accepted by the province of British Columbia. CPAWS and WWF have worked at all levels of the Canadian public process to forge links between conservationists, business leaders, and the government in order to establish a 12% or better system of representative

reserves by the year 2000. Given the willingness of most provincial governments (especially British Columbia) to protect the 12% minimum, the Endangered Spaces Campaign has a reasonable chance of succeeding in its goals (World Wildlife Fund Canada 1995).

The second project, the Yellowstone to Yukon initiative (Y2Y), is also a WWF Canada concept in conjunction with CPAWS and The Wildlands Project. These organizations are attempting to devise a process, based on conservation biology models, that identifies a system of reserves spanning the Rocky Mountains from the Yellowstone ecosystem in the U.S. to the Muskwa-Kechika region of far northern British Columbia. While the Y2Y concept is currently in a very preliminary stage of development, WWF has expressed the hope that other organizations working in the Rockies will join their efforts. But since there is no plan or clear set of project goals (beyond an intent to consider the entire span of the Rockies and to collect computer mapping data for developing a detailed reserve plan), few small groups have chosen to align themselves as yet.

Some smaller groups question the commitment of WWF and CPAWS to prepare and present an aggressive ecosystem reserve plan, given their clearly stated desire to maintain close ties with government and the business community during the 12% Endangered Spaces Campaign. Also, the Y2Y project and the Endangered Spaces campaign present two apparently divergent approaches to reserve protection (biodiversity

reserves vs. politically motivated land-use plans) coming from the same source. Grassroots conservation organizations working in the Rockies are watching developments with interest to see what the big groups will do with their proposals.

This skepticism has led grassroots conservation groups in the U.S. and Canada to prepare and present their own reserve plans for British Columbia utilizing the model provided by conservation biology. The use of the core/buffer reserve design approach provides conservationists an opportunity to define reserve plans that maximize the protection of biological diversity rather than attempt to strike a political balance between ecological and economic considerations. This identification of reserves based on biological value allows small organizations to shift the terms of the public dialog over land protection to include the essential perpetuation of biological integrity detached from the wants of local industries and communities. Ecological reserves designed solely to protect biological diversity serve as an essential baseline for political initiatives, and are thus a critical reference point in the dialog over the protection of wildland complexes.

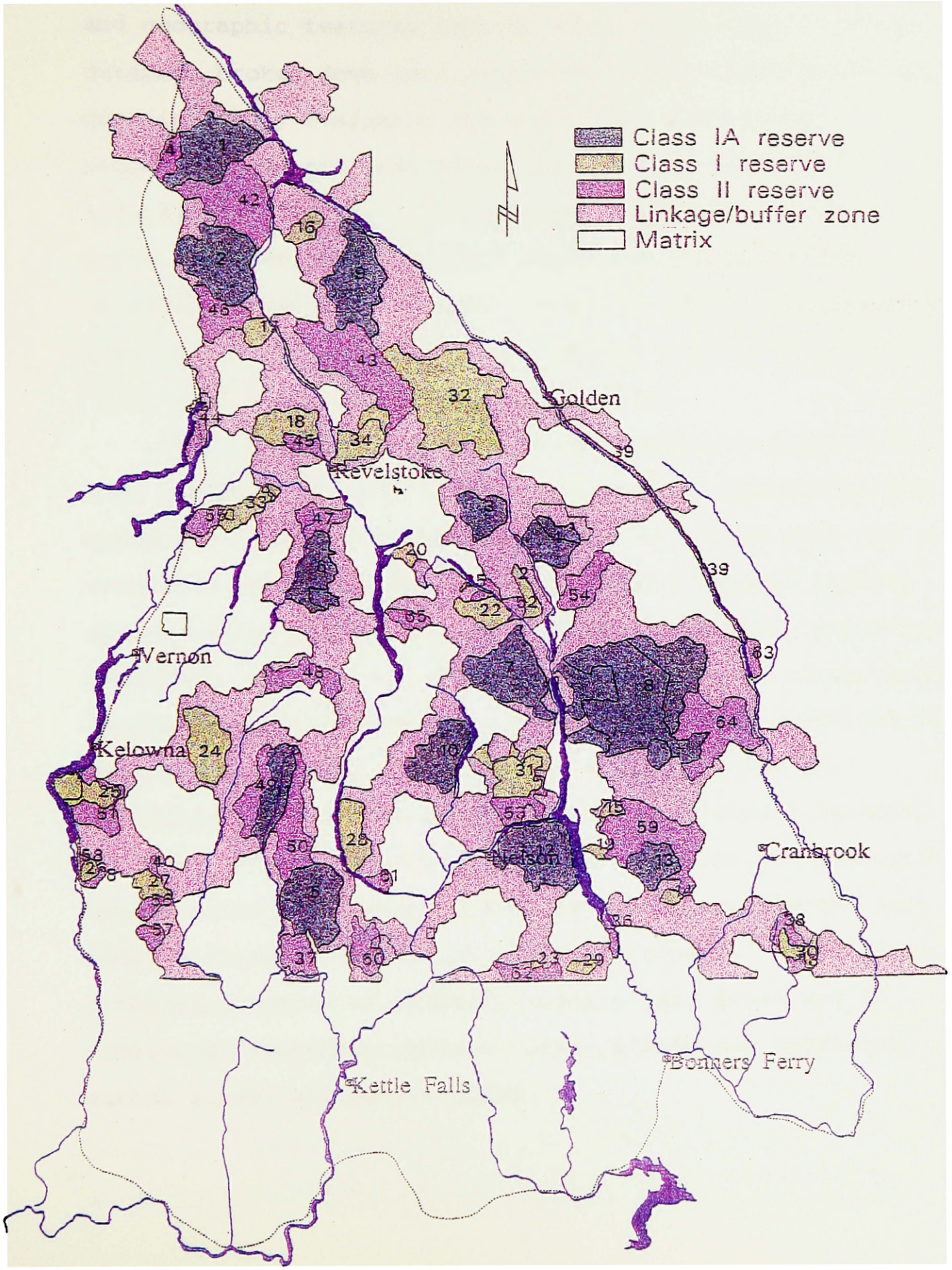
CHAPTER III
Conservation Biology Planning for British Columbia

In particular, the Northwest Ecosystem Alliance (NWEA) of Bellingham, Washington (a coalition of groups in British Columbia and the United States) is preparing reserve system plans for two regions of British Columbia using the conservation biology modeling system advanced by The Wildlands Project (Frost 1994, Frost and Snetsinger 1994). Their plan for the Columbia Mountains, located in southeastern British Columbia, proposes a biological reserve system of core protected areas connected by corridors and protected by buffer lands in the western portion of the Canadian Rockies (see Map 7 & Appendix III).

The Columbia Mountains Conservation Plan

NWEA's reserve system design for the Columbia Mountains closely follows the general model proposed by conservation biologists working with The Wildlands Project. Using the core/buffer concept as its foundation, the plan for the Columbias approaches reserve design from the biological standpoint. The planning process utilized biological data

Map 7 - Map of proposed Columbia Mountains regional reserve network, showing Class IA, Class I, and Class II reserves with linkage and buffer zones. From Frost 1994.



and geographic features mapping to produce a multi-layered database broken down into watershed units, which after being quantitatively evaluated and scored for significant biological factors were assigned a numeric ranking for biological integrity. This system, described in detail below, was designed to permit objective evaluation of criteria associated with each land unit within the planning area in order to quantitatively assess the biologically "best" lands for protection (Frost 1994).

The Columbia Mountains plan was organized using a four step methodology. The first step was data acquisition and mapping for key ecosystem features. The second step was an evaluation of the mapped features using a numeric ranking system rating watershed subdivisions for various conservation qualities, in order to identify areas with high conservation values. The third phase was to delineate the boundaries of a reserve system from the ranked watersheds, using the cumulative unit scores to assign each watershed a reserve priority rating. The final step was to develop a system of conservation management guidelines and priorities for each reserve class, to guide long-term management. These steps produced a system of priority reserve core areas set in a complex of secondary reserve cores, connecting corridors, buffer zones, and matrix lands.

Study Methodology

Data collection and mapping focused on six primary features: late-successional/old-growth forests; element occurrences of sensitive and endangered species; roadless lands; watershed conditions; wildlife corridors and barriers; and ecosystem types. Each of these features was mapped using 1:250,000 topographic maps for the study area. Individual maps were then transcribed onto mylar overlays consolidating the entire study area into a single sheet for each feature.

Forest stand data were obtained from the British Columbia Forest Service branch offices and from private timber lease holders. The data were initially compiled at a scale of 1:50,000, and then photo-reduced to a scale of 1:250,000 and mapped on mylar transparency sheets. Stand data were evaluated to select mature and old-growth areas greater than 120 years old, as well as to determine stand type (low elevation wet/moist, low elevation dry, and high elevation forest). In addition, timber sale records were examined to locate areas of recent harvest. Final stand data on mylar depicted forest older than 120 years classified into the three moisture/elevation categories, with harvested areas separated into clearcut or partially logged units.

Element occurrence information, obtained from the British Columbia Conservation Data Centre, measured the number of sensitive and endangered plants or animals found in the study area and number of observations for each individual species. These data were highly variable in coverage and

accuracy, since detailed surveys for sensitive species have not been completed in British Columbia.

Roadless lands were mapped using Recreation Opportunity Spectrum data obtained from the British Columbia Ministry of Forests, depicting roadless forest areas larger than 5,000 hectares. Comparing the ROS maps with the stand data indicated that many areas of roadless land have been modified by logging and other development. Thus, the roadless maps were updated using Forest Service coordinated access management plans at 1:50,000 scale, obtained from agency district offices. Any blocks of land greater than 1,000 hectares without roads or permanent human disturbance were considered roadless areas.

Watershed units were identified using 1:250,000 scale topographic maps. Watersheds were drawn by hand using heights of land and water features to define upper and lower boundaries, respectively. Units larger than 25,000 hectares were broken into logical sub-units using topography. A total of 504 separate watershed units were identified and assigned unique identification numbers. Development condition was assessed using a British Columbia Ministry of Forests inventory of watershed conditions, which ranked drainages from undeveloped to highly developed.

Wildlife corridors and impediments to travel were mapped by Canadian biologists working with the project. Using geographic features from topographic maps (water bodies, steep alpine terrain, ridge systems), information on human

development condition (intensive agriculture, urbanization, rural development), and records of wildlife use and migration, mylar maps were prepared illustrating probable travel routes through the landscape.

Finally, biogeoclimatic ecosystem classification (BEC) maps were used to assess representation of different land types for reserve candidates within the study area. BEC classes identify potential habitat type variations resulting from latitude, topographic and elevation differences.

Conservation Evaluation

The plan for the Columbia Mountains assessed the biological quality of each area using a ranking system which rated each of the above six factors for individual watershed units with a numeric value (1-10). These scores were then totaled to give a cumulative score out of a possible 60 points. These scores (0-20, 21-30, 31-60) then received a low, medium or high ranking for protection.

The decision to use watersheds as the basic evaluation unit was a key feature of this ranking system, based on several considerations: watersheds are diverse in terms of topography and elevation and thus include a variety of habitat types; protecting watersheds protects hydrologic function; watersheds contain intact natural movement routes; watershed boundaries and topography make them more easily managed for protection; and protecting watersheds provides a

benchmark to use for measuring change in related systems (Frost 1994).

Developing a Reserve Design

Using the overall ranking system, watersheds were rated for protection value. Reserves were centered around clusters of watersheds with medium to high value rankings, in addition to several other assessment criteria: distribution and proximity to other reserves; human disturbance; elevational and topographic diversity; frequency, size and intensity of natural disturbance; compatibility of adjacent land uses; and opportunity for redundancy of species, habitats, and ecosystems within reserves (Frost 1994). Areas adjacent to reserves but ranked in the low category were considered as linkage or buffer zones. Land designations were broken into five categories:

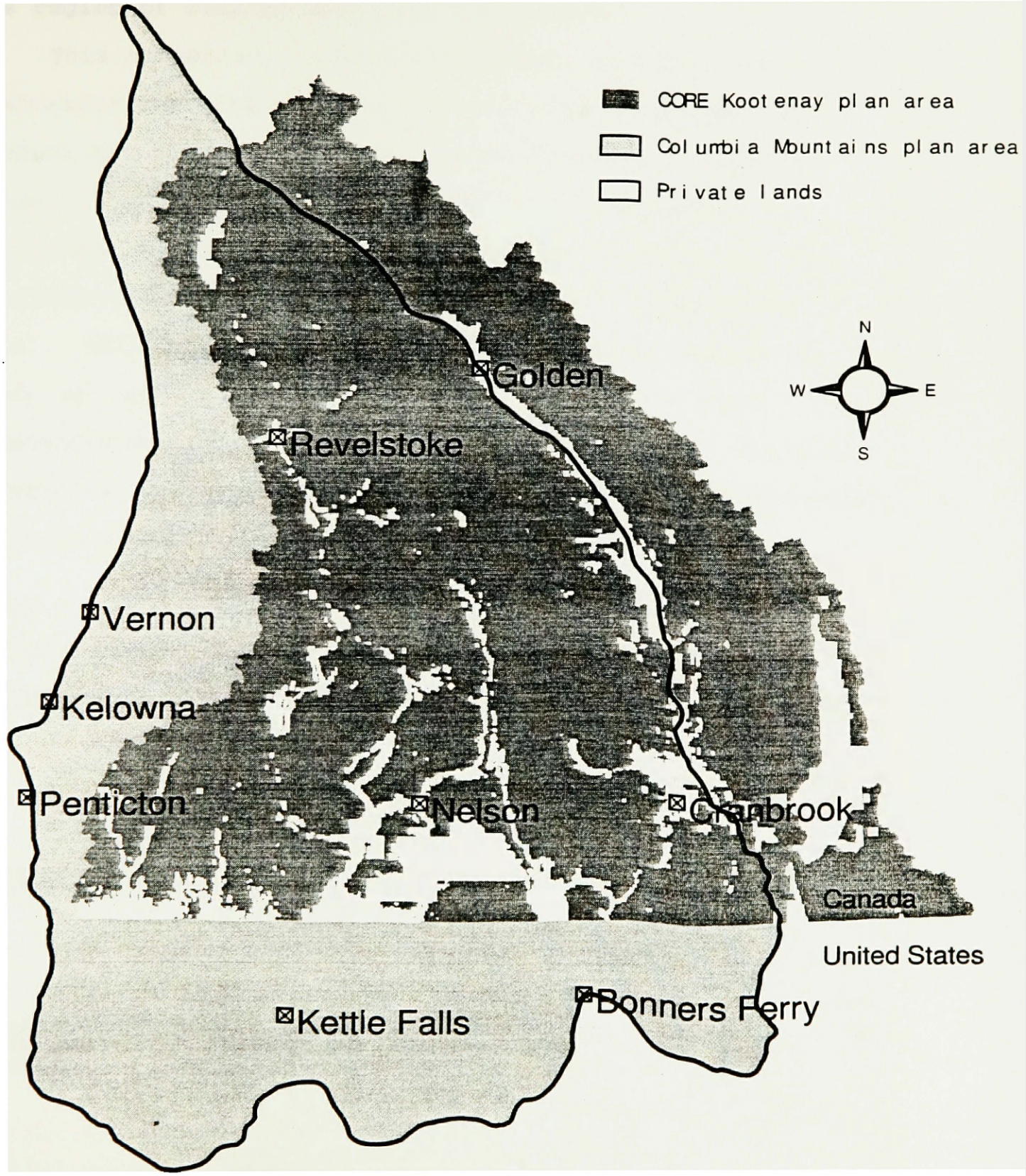
- Class IA Reserves - Very large to large undeveloped areas with minimal to no human development. Management emphasis focuses on maintaining the remote character of the landscape. These lands tend to be large wilderness areas which form the "anchors" of the conservation plan.
- Class I Reserves - Large to medium, relatively undeveloped lands where some recreational or other light development has occurred. Management emphasis is to minimize human disturbance and impacts. These lands include most previously protected areas such as national and provincial parks.
- Class II Reserves - Medium to small reserves that enhance representativeness and expand coverage of nearby reserves or linkages. Emphasis is to restore degraded areas, revegetate sites and reduce road densities.
- Linkage/Buffer Zones - Managed to maintain ecological structures and functions while permitting compatible uses.
- Matrix - All other lands in public and private ownership, emphasizing sustainable land-use practices. (Frost 1994.)

The reserve system proposed for the Columbia Mountains largely overlaps the two CORE land-use plans for the Kootenay region (see Map 8). This overlap presents an opportunity to compare and contrast the differing results of these two approaches to reserve design. Examination and comparison of these plans sheds light on the adequacy of land protection planning from the two major perspectives currently used in Canada, and will help facilitate the efforts of Canadian and American conservationists as they prepare a reserve system plan for the Rocky Mountains of British Columbia and Alberta complementary to the NREPA proposal.

Comparison of the Kootenay Plans and the Columbia Mountains Reserve System

Using the explanation of the two major reserve protection proposals presented above, and based on a review using GIS map data provided by British Columbia's Land Use Coordination Office and the Northwest Ecosystem Alliance, it is possible compare the CORE Kootenay proposals with the Columbia Mountains reserve plan. GIS maps were provided in ARC/INFO format by both the government and NWEA. These maps were imported into the same geographic reference system and projected together in order to spatially compare the location and overlap of reserves and habitat linkage zones between the two plans. Additionally, the GIS software was used to calculate the area of reserve and linkage zones for the

Map 8 - Overlay comparing the CORE Kootenay Plan with the Columbia Mountains Plan



plans, as well as to calculate the area of protected units in the region of overlap shared by both plans.

This comparison uses as its primary criteria for evaluation the effectiveness of each plan at protecting several key components of biological diversity; roadless lands, intact watersheds, and biological corridors. Protection of these ecological values is critical for the maintenance of biological diversity (Noss & Cooperrider 1994). While the PAS process utilized similar values to those set out by the NWEA, it included criteria which eliminated potential reserves from consideration. Table 1 presents a comparison of key reserve unit selection criteria for both plans.

Table 1 - Comparison of Plan Evaluation Criteria

	Columbia Mountains Plan	**CORE Kootenay Plans**
Watershed mapping	-used watersheds as basic unit of assessment -watershed development condition maps used (provided by British Columbia government)	-considered watersheds in identification of polygons, along with wildlife habitat areas and biogeoclimatic zones
Roadless area review	-used roadless areas as a key factor for assessing biological integrity	-roadless areas were considered in PAS process in order to identify potential study areas, but were not integral to CORE process
TES species evaluation	-considered all available data on threatened, endangered and sensitive species element occurrences from B.C. Conservation Data Centre	-considered habitat needs for individual species, particularly grizzly bear, woodland caribou, wolf, and furbearers

Old-growth forest evaluation	-utilized stand data from B.C. Forest Service to identify all old-growth regions -ranked late successional and old-growth stands as a key biodiversity value	-considered old-growth as part of timber volume and forest management assessment -individual old-growth areas were considered for recreational and biological value
GIS mapping	-did not prepare GIS database due to lack of resources	-prepared a comprehensive map database using data from government ministries
Corridors identified & protected	-ranked corridor identification as a key reserve design criteria -used map and biological data to identify probable corridors	-considered corridors as an important factor for land management -did not explicitly include corridors in the classification process
Level of protection for core reserves	-core reserves ranked for size and ecological integrity, with all development prohibited in Class IA and Class I reserves -Class II reserves permit some recreational and industrial development	-core reserves largely protected as provincial parks and wilderness, but with recreational development, logging, mining and road building permitted by order of Cabinet

In addition to the comparative summary of input criteria, GIS analysis of the reserve area maps illustrates the differences between the size and location of core reserve units protected under each plan, the location of corridors identified under the plans, the extent of buffer zones identified, and the total area of protected lands under each proposal.

Based on the comparison process, the following findings illustrate some of the differences between plans based on conservation biology modeling (NWEA plan) and plans

attempting to balance protection of biological diversity with sustainable development (PAS/CORE land-use plan process).

Comparison of Lands in Different Protective Classes

The draft Columbia Mountains reserve plan proposes to designate proportionately far more land in protected reserves than the CORE Kootenay plans. Class IA and Class I reserves comprise 1,376,186 hectares, or 18% of the Columbia Mountains. Combined with Class II reserves, which total 755,940 hectares or 10% of the region, protected areas equal 2,132,126 hectares or 28% of the region. In addition to fully protected lands, Linkage/Buffer zones total 2.3 million hectares, which is equivalent to 30% of the total area. Taken together, protected designations under the plan comprise 58% of the landscape.

This is in contrast to the area of land fully protected under the CORE land-use plans for the Kootenay region. Together, the CORE plans place 1,123,097 hectares of land in protected areas, or 13.6% of the combined Kootenay planning areas. Special Management areas, the CORE equivalent of linkage and buffer zones, equal 1,284,803 hectares or 15.6% of the area. The total of protected areas and areas which may receive special management treatment for corridor value thus equals only 29.2% of the Kootenay planning area.

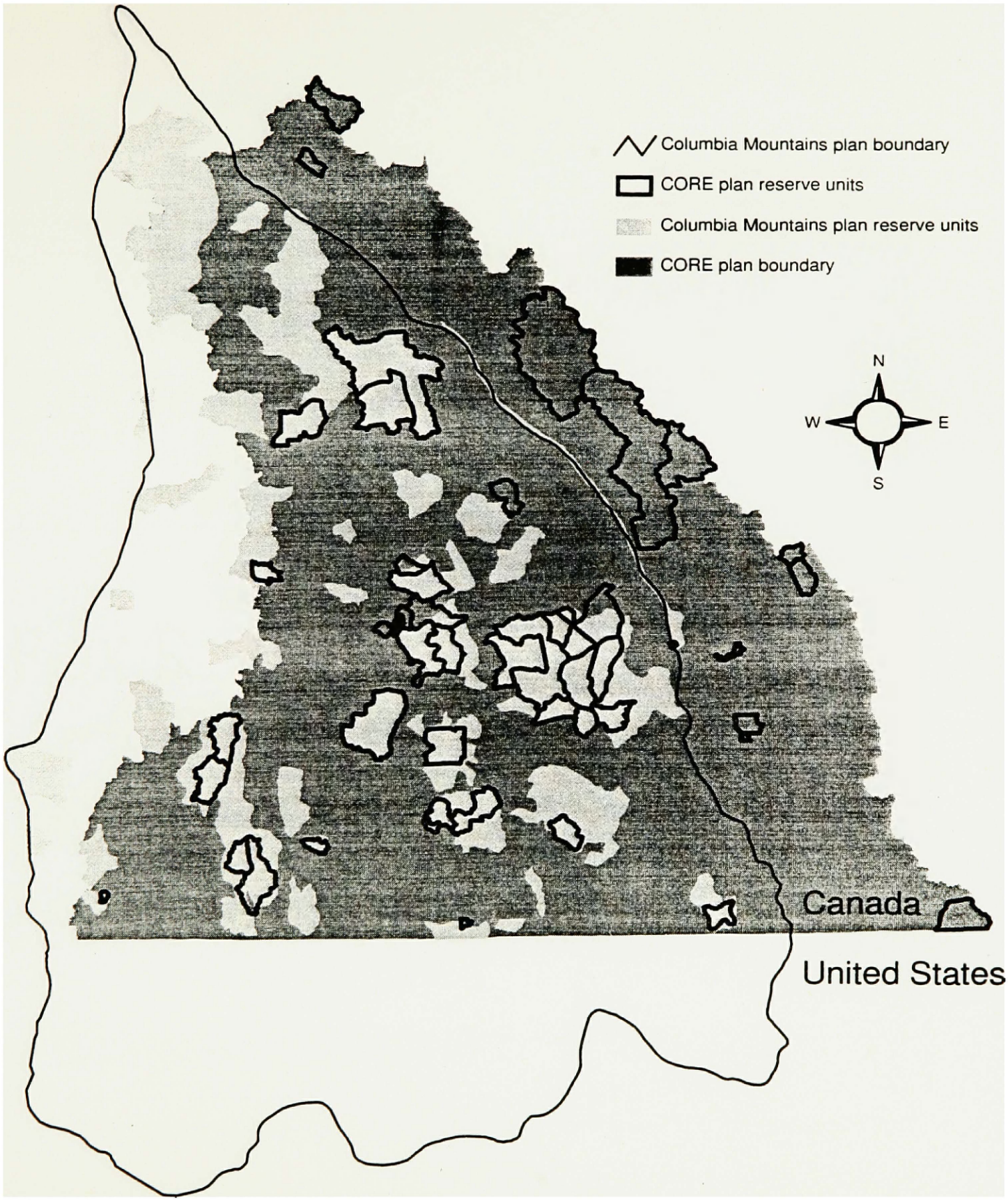
Perhaps more telling in the comparison of the two separate plans is the difference between protected areas in the overlap zone evaluated by both plans. As Map 8

illustrates, a significant area of land was studied by both the CORE and the Columbia Mountains planners. Reserves and habitat linkage zones were proposed for this area under both plans. Reserves designated under the CORE plan fail to cover the same amount of area as protected areas under the NWEA proposal (see Map 9). In the overlap zone, reserves created by CORE protect 726,888 hectares while the NWEA reserve system proposes 1,731,583 hectares for protection. This difference in area illustrates a significant disparity between the two plans in protecting lands identified by the NWEA conservation biology process as possessing high biodiversity value.

Further, the overlap area comparison shows that the NWEA plan defines 1,873,605 hectares as important wildlife migration corridors, while the CORE plan designates 1,036,540 hectares as Special Management areas eligible for consideration as linkages (see Map 10). This difference further illustrates the divergent approach between the two plans in their attempt to protect functional landscape level exchange of wildlife populations.

Table 2 below presents these figures for comparison. The differences in total percentage of land protected in reserve classes illustrates the disparity between the two reserve planning initiatives at protecting biological diversity.

Map 9 - Overlay of reserve units comparing the CORE Kootenay plan and Columbia Mountains plan



Map 10 - Overlay of linkage/buffer zones and Special Management Areas comparing the CORE Kootenay Plan and Columbia Mountains Plan

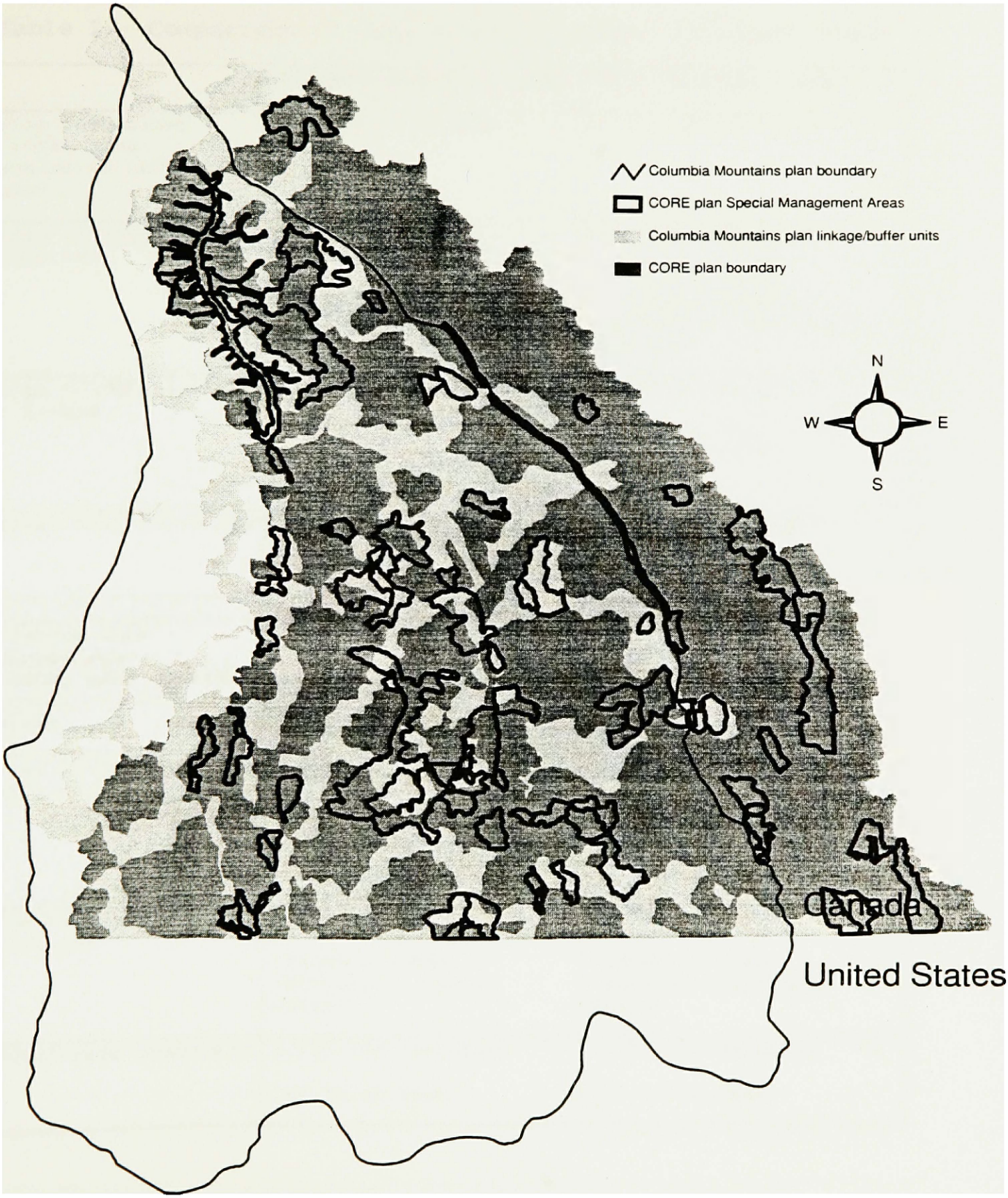


Table 2 - Comparison of Area Protected Under Different Plans

	Columbia Mountains Plan	**CORE Kootenay Plans**
Plan Comparison -total area evaluated under each plan	7,124,355 hectares	8,235,038 hectares
Area in core reserves	2,132,126 hectares -28% of area (Class IA, Class I, Class II reserves)	1,123,097 hectares -13.6% of area (provincial parks, wilderness, ecological reserves)
Area in habitat linkages	2,300,000 hectares -30% of area (corridors, buffer zones)	1,284,803 hectares -15.6% of area (Special Management Areas)
Total area protected	4,132,126 hectares -58% of area	2,407,900 hectares -29.2% of area
Overlap Zone Comparison -total area covered jointly by both plans	5,749,973 hectares	5,749,973 hectares
Area in core reserves	1,731,583 hectares -30.1% of area (Class IA, Class I, Class II reserves)	726,888 hectares -12.6% of area (provincial parks, wilderness, ecological reserves)
Area in habitat linkages	1,873,605 hectares -32.6% of area (corridors, buffer zones)	1,036,540 hectares -18.0% of area (Special Management Areas)
Total area protected	3,605,188 hectares -62.7% of area	1,763,427 hectares -30.6% of area

The NWEA plan set out to identify key biological components which still exist in the planning area, and to

quantitatively assess which of the land units reviewed were essential to the protection of intact ecosystem function. Biological criteria were the only factors considered, and this is reflected in the large area proposed for protection in core reserves and habitat linkages.

The CORE plans for the Kootenay region attempted to protect lands based on biological value as well as cultural, recreational and economic criteria. The protection effort was influenced by a strong emphasis on maintaining development options for local and regional economies. Because of the inherent conflict between ecological protection and extractive development, many areas which warranted protection based on their biodiversity value were instead included in the economic use classifications. This is clearly illustrated by the comparison of plan proposals in the overlap zone shown in Map 9 and Table 2. The percentage of the overlap zone landscape fully protected under the NWEA proposal is larger than that protected under the CORE plan, which omitted inclusion of important reserve and corridor areas identified by the Columbia Mountains plan.

The conclusion from the above review must be that the protection of biological diversity at the landscape level needs a clear planning emphasis on biological factors, to the exclusion of economic and social considerations. Development of plans based on biological assessment criteria present an opportunity for the public and government to understand which lands are critical for protecting biodiversity at the

landscape level. Biological planning also offers a baseline of data for assessing an adequate level of protection. Since government agencies face political difficulty in proposing plans which focus only on biological protection, it is essential for citizen groups to step in and undertake the required planning to the best of their ability.

Based on the conclusions from the above review, it follows that development of a biologically-based ecosystem reserve plan for the Canadian Rockies is an important step in defining an adequate level of resource protection for the region. The next step is proposing a methodology for the preparation of such a plan.

CHAPTER IV

Design Methodology for a Canadian Rockies Reserve System

Based on the above review of the major approaches and plans currently under consideration in British Columbia, it is possible to propose a planning methodology for protection of the remaining wild lands in the Rocky Mountains of British Columbia and Alberta. The plan should be compatible with the NREPA and be based on a combination of current conservation biology tenets and an assessment of pertinent laws and political mechanisms that will facilitate the actual implementation of the plan. The area under review will stretch from the U.S./Canadian border north to the Peace River, and straddle the British Columbia/Alberta border along the Rocky Mountain crest (see Map 11).

Borrowing from the Columbia Mountains Approach

The methodology will be similar to that developed for the Columbia Mountains reserve system. The most significant departures between that plan and the proposal for CANREPA will be the use of roadless public land as the basic planning criteria, and foregoing the attempt to utilize the very limited endangered and sensitive species element occurrence

Map 11 - Study area boundaries for a B.C./Alberta ecological reserve complex.

data collected by the British Columbia Conservation Data Centre.

Watersheds will not be used as the base planning unit, in order to avoid the fragmentation of significant blocks of roadless land into smaller pieces (often the heads of watersheds). Fragmented roadless areas often receive a lower "score" in the evaluation phase of the planning process. Element occurrences will be omitted as a key planning factor. Survey data is inconsistently available for the Rocky Mountain region, and the lack of quality data prevents the use of element occurrence information as an objective evaluation criteria. Element occurrence data will be used anecdotally in the final review and ranking of reserve units, to ensure that what is known about sensitive and endangered species is not overlooked in the final evaluation. As with the Columbia Mountains plan, our analysis process will involve four stages.

Step 1: Mapping

Stage one will be the acquisition of map and biological data at a consistent scale for the entire study area. The scale selected will be 1:250,000. The British Columbia and Alberta governments have collected and organized a vast resource of information at 1:20,000, 1:50,000, 1:250,000, and 1:2,000,000 scale, by order of decreasing detail. Given the large study area and the problems with obtaining and using a large number of very detailed maps, the mid-level scale of

1:250,000 was selected. Much of the more detailed information has been aggregated up to our chosen scale, and it will be possible to use more detailed maps to supplement 1:250,000 when necessary.

As a base map series, digital GIS restructured positional files for the entire study area will be obtained from government agencies. These will be supplemented by paper topographic map copies for use in the field. The digital coverages contain contour and digital elevation model layers, as well as reference grids, toponomy, planimetric features, survey control points, reference data and wooded areas.

These digital maps will provide a detailed GIS series to serve as the base for all additional information layers. Other GIS layers which will be obtained or generated from paper maps and other information are: cadastral land ownership surveys; forest cover stand data (emphasizing mature and old-growth stands and harvested areas); ecological land classification maps; biogeoclimatic data; probable migration corridors and barriers; roads; recreational opportunity spectrum maps (depicting roadlessness); existing protected areas; and protected area vision maps prepared by conservation organizations. Each of these data sets are described in detail below.

The cadastral survey data depicts land ownership. Highly relevant to a reserve system design is the legal process by which reserve units may be protected. We will

distinguish between lands in public and private ownership and rank the different ownerships by prioritizing reserves on public lands. Important as some private lands may be for conservation, it is not feasible to identify lands without legal prospect of implementing reserve designations. Land ownership maps will allow us to accurately assess how much land is in public ownership.

Forest cover maps, obtained in GIS digital format from the Ministry of Forests at 1:250,000 scale, depict stand age and habitat classification. These data will permit the identification of late successional and old-growth patches in the reserve areas, which can then be prioritized for protection. Stand data also depict areas which have been logged, the time since harvest, and the regeneration class. This provides a measure of disturbance to stands, which allows an objective assessment of remaining biological value to different species.

To supplement stand data, ecosection and biogeoclimatic map data will be incorporated in the analysis process. Ecosection maps will permit GIS evaluation of how well the reserve components represent the total number of potential ecological provinces and sub-types with British Columbia and Alberta, while biogeoclimatic maps will aid in assessing the coverage of potential vegetation classes (based on landform and climate) by the reserve units.

Forest cover maps also depict the network of forest development roads which exist in the study area. Road

networks have a significant impact on the quality of land as biologically valid reserve units, with biological value in an inverse relationship with the density (linear miles per square mile) of road in an area. Accurate depiction of road location in GIS format allows an evaluation of current watershed development condition, which complements the stand data. Further, since roads act as barriers to migration by wide-ranging species (Noss & Cooperrider 1994), the road layer will serve to supplement the corridor information as well.

Recreation opportunity spectrum data provide a rough measure of roadlessness on the landscape. This is a key measure of biological value that will be assessed in delineating a reserve proposal. Using the different ROS classes in conjunction with the road layer and stand disturbance data, it will be possible to accurately assess the location and size of remaining blocks of roadless land. Roadless lands are identified as the highest priority for protection within the reserve system.

Corridors will be identified using topographic maps and GIS digital elevation models to determine geographic features such as ridges, valleys, and water bodies. Steepness of terrain and human development are key elements which promote or prevent use of lands as migration routes. In addition to physical features, local and regional biologists and activists will be contacted to annotate maps with locations

of known migration routes, and computer database records of wildlife use will be incorporated where possible.

Existing protected areas and areas proposed under other reserve plans will be evaluated to determine how well our plan protects areas identified as critical under other conservation plans. Land ownership data will provide details of existing reserves, while land-use plans and vision maps produced by other conservation organizations will be used to illustrate where additional reserves are proposed. This layer, with the exception of existing reserve units, will portray the hypothetical union of all existing reserve system protected area sets.

The final data set will be element occurrences (EO) of threatened, endangered and sensitive species information. These data are fragmentary for the study area, but may shed light on specific areas which deserve special protection. The EOs will be entered as point data and draped over the other data layers to ensure that known sensitive species hot spots are not overlooked.

Step 2: Features Evaluation

Using the multi-layered GIS database, we will evaluate the conservation value of lands within the study area using public ownership, roadlessness and mature, undisturbed native forest stands as key components. Starting with public lands as the basis for our initial assessment, we will overlay roadless land and late successional/old-growth forest

polygons to assess the maximum overlap of these three key features.

Features ranking will be based on the following criteria, with numbers 1 through 5 to be classed as type I core reserve candidates and 6 through 9 classed as type II core reserve candidates:

Table 3 - Core reserve designation criteria

Rank	Development Condition	Special Features
1	Roadless public lands >5,000 ha.	LS/OG stands in blocks >1,000 ha.
2	Roadless public lands >2,000 ha.	LS/OG stands in blocks >500 ha.
3	Roadless public lands >1,000 ha.	LS/OG stands in blocks >250 ha.
4	Roadless public lands >2,000 ha.	
5	Roadless public lands >1,000 ha.	
6		Public lands with LS/OG stands in matrix blocks >1,000 ha. <0.5 mi./sq. mi. of road
7		Public lands with LS/OG stands in matrix blocks >500 ha. <0.5 mi./sq. mi. of road
8		Public lands with LS/OG stands in matrix blocks >500 ha. <1.0 mi./sq. mi. of road
9		Public lands with LS/OG stands in matrix blocks >250 ha. <1.0 mi./sq. mi. of road

Using the above ranking system as the basis of scoring lands for conservation value, other key features will be factored in as well. In order to assess representation of different ecological classes and habitat types, ecological land classification and biogeoclimatic maps will be layered over the ranked areas. The goal of representing all land types will be evaluated from this overlay, and if classes are omitted, then private lands or more fragmented blocks will be considered for inclusion in the higher ranks. Additionally, element occurrences will be layered into the ranked classes to assess biodiversity hot spots. Areas with concentrations of EOs will be increased in their base rank, depending on total EOs and number of EOs for different species.

Using the above information, connectivity factors will be layered into the matrix. Known migration routes, routes that traverse obvious geographic corridors, and probable corridor routes will be assessed using several factors. Using road density and disturbance data, potential corridors between core areas will be ranked. EO and other wildlife data will be utilized to assess possible travel routes. Areas with obvious geographic barriers will be eliminated from consideration.

Connectivity will be assessed using the following characteristics, with lands in categories 1 and 2 will be assigned a high corridor value and designated as key protection candidates. Lands in category 3 will be

identified as having some corridor value and set aside for further study:

Table 4 - Habitat linkage designation criteria

Rank	Special Features	Landscape Features
1	Public lands <0.5 mi./sq. mi. of road	-excellent physical movement paths (ridges, valley bottoms, no major obstacles) -some small roadless areas linked by low road density lands
2	Public lands <1.0 mi./sq. mi. of road	-good to poor physical movement paths (ridges, valley bottoms, some major obstacles) -some small roadless areas linked by low road density lands -private lands
3	Public lands <2.0 mi./sq. mi. of road	-poor physical movement paths (steep ridges, alpine terrain, major obstacles) -private lands

Buffer lands will be assessed based on ownership and their proximity to primary and secondary core reserves and corridors. Buffer lands will be identified from the matrix lands using topographic features (screening ridges, water bodies) and using such factors as undisturbed forest stands, low road density (<2.0 mi./sq. mi.), and habitat type. In the designation of buffer zones, the impact of edge effect will be taken into consideration. Edge effect is the measurable climate and species disturbance that occurs within intact forest stands which border disturbed areas. A common measure of minimum edge effect range is three times the height of the forest canopy (Harris 1984). We will

generalize this further to incorporate the suggested minimum disturbance distance from roads and clearcuts that grizzly bears are known to observe. Minimum buffer width will be 0.5 miles outside of core reserve and corridor areas to ensure maximum habitat protection within the reserves (Interagency Grizzly Bear Committee 1995).

Matrix lands will be all other rural public and private lands within the study area, excluding population centers and lands with intensive agricultural development.

Step 3: Reserve Design Section

Once all data mapping and ranking evaluation is complete, the ranked land units will be defined on maps and assigned final classifications as different reserve components. This section will be supplemented by a discussion of the criteria for each reserve class based on the ranking criteria but also including such details as size of reserves and special features. The design will be compiled into a single large map in GIS format, accompanied by additional maps depicting all the individual data layers that were used to prepare the composite map.

Step 4: Recommendations

We will prepare a report detailing our results upon completion of the above steps. Our results will be submitted to a review by biologists and activists in Canada and the United States prior to publishing. Accompanying our results

will be detailed maps depicting the areas identified for protection under various classes, as well as the multiple layers of data that went into the determination of reserves.

The results section will define the management criteria associated with each different reserve classification, including such considerations as minimum size and permissible human activities.

Finally, working with groups in Canada, we will review the process by which the reserve system might be implemented in the current climate of Canadian politics and public opinion. This section will discuss who will be responsible for carrying the report to the public and to government agencies, how to develop a plan of action for advancing the proposal in the parliament at the provincial and federal levels, and how to develop a time line for implementation.

Chapter V
Using Law and Politics to Protect the Rockies

Ultimately, the most scientifically valid reserve system proposal is only as good as the legislative and political framework which protects it through a formal legal status. In addition to the choices planners make to include specific areas within a reserve plan, the planners must choose an implementation strategy using existing law and legislative process to define the designations for lands included in the system.

This component is the final major consideration which must be discussed in evaluating the prospects and process of creating an ecosystem reserve complex for the Canadian Rockies.

Existing Laws to Protect Canadian Parks and Wilderness

In the process of identifying and protecting reserve systems, it is easy to omit consideration of whether adequate legislation exists which can effectively protect the lands identified in a proposal. Essential to a functioning reserve system are strong laws which guarantee that the lands designated as wilderness or parks are actually protected from harmful development activities such as dams, logging, mining,

road building, and destructive recreational projects. The Canadian legal system has a variety of laws that offer protection for parks, wildernesses, and ecological reserves, but some of the designations offered do not effectively protect the land in perpetuity. A brief review of Canadian federal and provincial legal mechanisms will clarify the difference between strict and flexible reserve designations.

Federal Legislation

Authority to govern in Canada derives from the Constitution Act of 1982, formerly the British North America Act of 1867. This legislation places the bulk of decision-making authority for natural resource management under provincial control. The practical application of this law is that the federal government defers control of the majority of Crown lands and most decisions for protection of natural areas to the provinces, or acts in cooperation with them (Rankin 1990).

The major exception to federal deferral of authority for land management (aside from control of military reservations) is the retention of authority to designate national parks under the National Parks Act of 1970 (S.C. 1970, c.N-13). This law permits the preservation of areas with nationally significant ecological, geological and scenic features, and requires a level of protection adequate which leaves park units "unimpaired for future generations." Parks are identified through a study process initiated by the federal

Cabinet, with legislated designations following amendment of the National Parks Act to include official registry of new park boundaries. While federal authority also permits the designation of wildlife areas and migratory bird sanctuaries,[4] these areas do not preclude commercial or industrial uses within their boundaries and are thus not fully protective reserve classes (Hummel 1995).

While the Canadian national park system involves a vast area of land, it is only projected to be some 60% complete based on the representation of land types (Hummel 1995). Even though the federal government is actively pursuing a park expansion program, the majority of protection efforts occur at the provincial level. British Columbia in particular has established a wide variety of protected area designation laws, although many of the laws do not provide complete or permanent protective designations.

Protection Methods in British Columbia

Provincial protection laws may be segregated into two major classes, following the criteria set out by the International Union for the Conservation of Nature: strictly protected areas designated primarily for the protection of biological diversity, and other categories which permit controlled resource exploitation with significant but limited

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[4]National Wildlife Areas are designated through order-in-council by the Cabinet under the Canada Wildlife Act of 1973 (S.C. 1973-74, c.21), while migratory bird sanctuaries are authorized by the Migratory Birds Convention Act of 1980 (S.C. 1980, c.21) without explicit land acquisition authority.

protection of biological diversity (IUCN, cited in Rankin 1990). Designations such as ecological reserves, national parks and Class A provincial parks fall under the first type of protective designation, while wilderness areas, national wildlife management areas, migratory bird sanctuaries, and recreation areas fall into the second category.

Lands are designated for protection under these acts in three principal ways. The most common method is through Cabinet by order-in-council of the Lieutenant Governor. This is an executive decree which has binding force under the authority of a specific piece of legislation. However, this method is also revocable by subsequent order-in-council and is therefore a somewhat tenuous protection mechanism (Valhalla Society 1988).

The second protective designation is by administrative arrangement by or between agencies of the provincial government, utilizing the land-use planning process and administrative authority invested by the land management laws which enable the government bureaucracy. This, too, is a tenuous protection method since administrative agreements vary with changing governments and cabinet ministers.

The third, and most durable, of the designation mechanisms is the passage of a specific Act by the provincial Legislative Assembly. This carries the force of law as do the other designation methods, but requires a subsequent parliamentary action to reverse a decision. Reserve lands designated by act of the Legislative Assembly are the most

likely to persist in protected status over the long term (Rankin 1990).

British Columbia Laws for Land Protection

The laws of British Columbia which offer explicit protected status for Crown lands are the Parks Act, the Ecological Reserves Act, the Environment and Land Use Act, the Forest Amendment Act, the Land Act, and the Wildlife Act. Each of these laws provides some measure of land protection, with the degree of protection varying with the intent of the law and the method of designation.

Currently, the only law in British Columbia that grants strict, unequivocal protection of biological diversity is the Ecological Reserve Act of 1979 (R.S.B.C. 1979, c.101). The emphasis in the Ecological Reserve Act explicitly is upon preservation. Recreation is permitted but not encouraged, and all industrial and motorized uses are strictly prohibited. This act, the first of its kind in Canada, is the only legislation currently available to protect core reserve areas without any provision for permission of development activities. It is comparable to the Wilderness Act in the United States as a protective designation (Rankin 1990). Unfortunately, it has been used primarily for the designation of small reserves for scientific purposes and has not been utilized for the designation of large ecological reserve complexes.

The Park Act of 1979 (R.S.B.C. 1979, c.309) is by far the most common and widely used protection law in the province, and designates lands in three categories: Class A and Class B parks, and Recreation Areas. Class A parks are fully protected from resource development pressure, except for the allowance of limited recreational facilities to facilitate public use of the park. Class B designation, however, allows for industrial uses such as logging, mining and recreational development under special permits issued by order-in-council of the provincial government.[5] Numerous British Columbia parks have been designated by order-in-council, and it has been a common practice for class designation to be modified from Class A to Class B, or for parks to be declassified altogether under pressure from special interest groups (Valhalla Society 1988).

There has been a steady erosion of Class A parks into Class B status, in order to facilitate increased access to mineral or timber resources. Further, during the 1980s there was a movement to modify the classification of Class B parks into small areas of Class A land adjoining even less protected Recreation Areas, leaving a fragment of protected park surrounding or surrounded by park lands with virtually no meaningful protection from resource development. Under the Park Act, Recreation Areas allow extensive logging, mining and other development by order-in-council permit. The

[5]The order-in-council process involves the sponsorship of a proposal by a Minister before the Cabinet. Where order-in-council decisions are available, the Cabinet endorses or denies the proposal and the Premier passes endorsed proposals to the Lieutenant Governor for signature.

case of British Columbia's Strathcona Park serves as an example. Originally a Class A park, Strathcona was downgraded to Class B status. Then in 1988, the Park's Class B status was further modified to include areas of Class A and large sections of Recreation Area which were then leased to a mining consortium for large-scale mineral development (Valhalla Society 1988).

Only national parks, Class A provincial parks and ecological reserves fit the *British Columbia Protected Areas Strategy* definition for protected areas, which are "areas in which no industrial resource extraction or development is permitted. No mining, logging, hydro dams or oil and gas development will occur within protected areas" (British Columbia Protected Areas Strategy 1992).

Existing legislation for wilderness areas, forest recreation areas, and wildlife management areas are even less protective and allow various levels of industrial activity. The Forest Amendment Act of 1987 (B.C. Reg. 280/87) permits the designation of Crown forest lands as wilderness areas by order-in-council, but provides no legislative means to ensure the permanent protection of lands as wilderness (Rankin 1990). Designated wilderness areas persist only at the forbearance of the provincial government. While the Forest Amendment Act provides for the full protection of wilderness areas during their designation as wilderness, subsequent orders-in-council may negate the protective status at any time without public oversight.

The Environment and Land Use Act of 1979 (R.S.B.C 1979, c.110) allows a provincial land management oversight committee, appointed by the Lieutenant Governor on the recommendation of the Cabinet, to evaluate land-use decisions and allocations and make recommendations to the Cabinet for land-use changes by order-in-council. Wilderness areas may be designated under the Environment and Land Use Act in the same manner as the Forest Amendment Act, and they may be revoked as easily (Rankin 1990).

Finally, lands may be designated in protective status using the Wildlife Act of 1982 (R.S.B.C. 1982, c.57) and the Land Act of 1979 (R.S.B.C. 1979, c.214). The Wildlife Act allows the Minister of Environment to designate areas for the protection of wildlife, with the consent of the Cabinet. The Land Act permits the transfer of lands between government agencies, accompanied by administrative agreements conferring protective designations (Rankin 1990).

Canadian Government Structure

Determining which laws will work to protect a biologically-based reserve plan is the final step in designing a proposal. But once a proposal is prepared, it must be taken to the public by individuals and groups who will advocate its enactment into law. This step requires an understanding of the legislative course which a reserve proposal must navigate in order to become law. While this review must be cursory due to the complexities of the

Canadian political system, a brief discussion of Canadian government procedure is in order.

The Canadian government is a constitutional monarchy with a parliamentary system for popular representation. While ultimate authority technically derives from the British Crown through the person of the Governor General, the actual operation of the federal government is by the Prime Minister and Cabinet of the majority party in the parliament (Metcalf 1982).

The provincial system parallels the federal structure, with a largely symbolic Lieutenant Governor appointed by the Governor General to represent the Crown, and a Premier and Cabinet of appointed Ministers selected from the majority party in the Legislative Assembly. The Legislative Assemblies of the provinces are elected by popular vote from electoral districts determined by population size. Popular elections establish the composition of the Assembly and the majority party (or party coalition if a majority is lacking) selects a Premier. The Premier then designates Ministerial candidates and the Lieutenant Governor appoints Ministers for the various departments of government to form the Cabinet (Metcalf 1982).

Legislative Process

There are four major mechanisms for the passage of laws in Canada: orders-in-council, majority bills, private member's bills, and popular referenda. While the first two

of these mechanisms lack significant opportunity for grassroots access, the third and fourth methods offer a measure of popular access to the legislative process.

The Canadian parliamentary system is tightly controlled by the executive, with strict party discipline to the ruling government the norm (Atkinson 1993). Because of this formality, legislative proposals almost always originate with the Cabinet and are sponsored in parliament by individual Ministers. Laws are passed as orders-in-council of the Cabinet through the person of the Lieutenant Governor, or as bills presented by the Cabinet for vote by the Legislative Assembly.

Party discipline dictates that bills presented by the government nearly always receive passage from the Assembly, because the majority of seats are held by the ruling party of the Premier (Metcalf 1982). British Columbia in particular traditionally has had a strong executive, so the parliament commonly follows the dictates of the Premier and Cabinet (Brownsey & Howlett 1992).

In contrast to the American legislative system there is little opportunity for rank and file (back bench) members in opposition parties to offer legislation not sanctioned by the executive (Atkinson 1993). Private member's bills may be advanced by parliamentarians of the majority or minority parties, but these are uncommon and lack the support of the traditionally strong party discipline of Canadian politics (Metcalf 1982). While lacking strength, private member's

bills may be the only forum for advancing a radical ecosystem protection strategy in the parliament, especially one that crosses provincial boundaries.

The use of the private member's bill has occurred in relation to environmental protection efforts. A member of the Ontario Legislative Assembly introduced a private member's bill several times while in the opposition party, to create an environmental bill of rights for Canada. While these bills did not pass the parliament, the process advanced the cause espoused by the bill's sponsor and brought the concept of an environmental bill of rights to the national agenda (Atkinson 1993).

The final method of changing government policy available to the public is the use of the referendum process (Metcalf 1982, Dyck 1986). While public referenda have been used very rarely in Canada, they are available to citizens in both British Columbia and Alberta. Referenda have tended to be of only local importance, although several examples of nationally significant policy initiatives exist (Metcalf 1982). The most recent such example is the attempted secession by the province of Quebec from the Canadian union. The use of the public referendum may be of some use to conservationists working for multi-province reserve protection, even though there is no precedent for a popular vote on public land management decisions.

Conclusion

As can be seen above, there are several pieces of legislation that afford effective and permanent protection for ecological reserves, and two possible legislative avenues which offer options for presenting a reserve plan to the public. Pursuing a federal and provincial legislative strategy to designate a landscape level reserve system using designations under the Ecological Reserves Act and the Park Act would provide secure protection to a Rocky Mountains reserve complex. Such an approach is feasible under the existing legal system, although it may be a challenge to propose new protected areas in addition to those designated in British Columbia's recent CORE land-use planning process.

Political Prospects for Creation of a Canadian Rockies Reserve

The current prospects for the passage of multi-province legislation protecting a reserve complex spanning the Canadian Rockies present significant challenges. The extensive land-use planning process in British Columbia has recently produced a new complex of reserves, and the CORE land-use planning teams are now considering how to implement additional protective designations for connecting corridors and buffer zones around core areas. The efforts of British Columbia's government have expanded the reserve system in the province, which is beneficial for the preservation of

biological diversity. And although this land-use planning activity has dramatically reduced the likelihood that the government or the public in the effected areas will be responsive to calls for additional protection, the British Columbia process may have a positive leverage effect on neighboring Alberta and the United States to develop comprehensive biodiversity protection plans. The process of aggressive provincial planning presents an example of what can be done to protect land using a government-sponsored planning process.

But while the British Columbia example may present a useful leverage point on its neighbors, the Alberta government to date has resisted the trend to protect public land. The poor track record of government and industry in fostering a reserve planning process stands in contrast to the clear public support for an expanded reserve system. Such public support presents an opportunity to pressure the government of Alberta to move ahead with reserve planning, and offers the chance that presenting a citizen-sponsored plan may help shape the terms of the pubic dialog over ecosystem protection efforts.

Given this situation, it seems quite possible that a scientifically-based reserve system proposal would be met with strong public support. The reserve designation process is not yet over in Alberta, so the direction of the process still may be shaped by a carefully designed conservation biology proposal.

In general, the development of a comprehensive reserve system for the Canadian Rockies that is compatible with NREPA will be a useful effort for conservationists to undertake. The identification of an accurate picture of the lands with high biological value which deserve protection will aid other ongoing efforts to protect ecosystems in both Canada and the United States.

Knowledge of the critical landscape components necessary to maintain functioning ecosystems is essential for activists evaluating governmental and private development proposals. Campaigns to designate wilderness and park areas for the preservation of biological diversity are essential components of the public education efforts of groups working to inform people of the need to preserve habitat at the landscape level.

In order to encourage the public to press for government protection of key lands, wild lands must be identified using the best available scientific and management data. It is essential to know what we are asking for when approaching the public and our elected representatives, in order to accurately communicate our desires. The development of a conservation biology-based ecosystem reserve complex for the entire span of the Rocky Mountains is an important step towards protecting wild lands in both the United States and Canada.

A Final Word

Ultimately, all of the knowledge and experience described above must come together in a plan for the Rockies that will share two key features: the plan must be biologically-based and adequate in size and scope to protect all species and their key habitat over the long-term; and it must be possible for citizens and their elected representatives to implement the plan before the fragmentation of habitat progresses too far.

Conservation biologists have mapped out a feasible strategy to preserve intact blocks of wildland habitat. While opinion may not unite on all of the details, most conservationists agree that we need to use the methods of science to form the basis of the reserve plans we will take to the public and our governments. The plans must be big, containing all remaining unfragmented wildland habitat. The plans must connect all of their components and interconnect with other plans in adjoining greater ecosystems. The plans must be based on strong laws which can protect the land through different reserve classifications. And the plans must be implementable, which means they need proponents who know how to present them to the public and the government, and who are willing to do it now.

There still remain great opportunities to protect important parts of the natural world, and if protection is possible anywhere it is in the United States and Canada. Wildland habitat and intact species assemblages still exist

in many areas, protective laws are available, and a significant proportion of the public is educated and motivated to protect wild land for posterity. What we lack are the clear and practical plans identifying the lands we must protect.

APPENDIX I

EAST KOOTENAY REGIONAL LAND-USE PLAN
DESIGNATION BY POLYGON
(from Province of British Columbia 1995b)

Management Guideline Categories:

A	Old Growth Dependent Species	I	Visuals
B	Wide Ranging Carnivores	J	Recreation/Sense of Solitude
C	Fisheries	K	Heritage/Cultural
D	Natural Grasslands	M	Coal and General Mining
E	Agriculture (Grazing)	L	Tourism Commercial
G	Ungulate Winter Range	N	Tourism Visuals
H	General Biodiversity		

Polygon Number	Unit Name	Designation	Management Guidelines	Area (ha.)
1-01	Wigwam-Lodgepole	Integrated	C,D,G,K	31,446
1-02	Flathead-West Side	Integrated	C,G,K	45,625
1-03	Flathead River Corridor	Special Mgmnt.	B,C,G,H,K	31,445
1-04	Sage/Commerce Creeks	Integrated	B,C,J,K	25,924
1-05	Upper Wigwam East Side	Special Mgmnt.	B,C,G,H,J	16,377
1-06	Akamina	Protected		22,193
1-07	Grasmere Face	Integrated	G	14,133
1-08	Mt. Broadwood Nature Conservancy	Private		12,713
1-09	Elko Face	Integrated	B,K	2,743
1-11	Harvey Creek	Dedicated	B,C,G,H,K	3,140
1-12	Wigwam West Side	Special Mgmnt.	B,C,G,H,J,K	16,479
2-01	Lower Elk-East Side	Integrated	C,G,J,K	21,209
2-02	Shell-Elkview-Dominion Block	Private		76,494
2-03	Andy Good/Corbin	Integrated	A,B,K,	14,944
2-04	Upper Flathead Basin	Special Mgmnt.	B,C,H,J,K	16,351
2-05	Lodgepole Block - Shell Lands	Private		2,029
2-09	CPR Block	Dedicated	B,C,H,J,K,N	1,955
3-01	Shell/Coal Company Lands	Private		57,638
3-02	Elk Valley - East	Dedicated	C,G,K	59,124
3-03	Upper Elk - West Side	Special Mgmnt.	B,G,H,K	56,626
3-04	Cadorna Creek (Elk Lakes Recreation Area)	Protected		11,302
3-05	Elk Lakes Provincial Park	Protected		5,857
3-06	Greenhills (Private)	Private		1,176
3-07	Connor Lakes - Height of Rockies Wilderness	Special Mgmnt.	A,B,C,D,E,G,H,I,J, K,L,M,N	13,199
3-08	Limestone Range	Integrated	B,G,H,J,K	22,804
3-09	Cadorna Creek (North Side)	Integrated	B,C,H,J,K,L,N	7,467
4-01	Bull-White-Kootenay	Integrated	C,K	417,135
4-02	Sulphur-Iron-Sand Creeks	Integrated	C,K	50,465
4-03	Height of the Rockies	Special Mgmnt.	A,B,C,D,E,G,H,I,J, K,L,M,N	53,532
4-04	Diorite Creek - Premier Face	Special Mgmnt.	A,B,C,G,H,I,J,L,N	12,322
4-06	Upper Galbraith	Special Mgmnt.	A,B,C,D,G,H,I,J,K, L,N	9,984
4-07	Steeples - Mt. Fisher	Special Mgmnt.	B,G,H,J,K	14,388
4-08	Top of the World	Protected		8,777

	Provincial Park			
4-10	Whiteswan Lake Provincial Park	Protected		2,140
5-01	Cross River	Integrated	B,L,N	42,127
5-02	Magnesite Creek	Special Mgmnt.	A,B,H,J,N	6,883
5-04	Assiniboine Prov. Park	Protected		39,080
6-01	Kootenay National Park	Protected		138,591
7-01	Beaverfoot	Integrated	B,L,N	53,800
7-02	Moose Creek	Special Mgmnt.	B,H,L,M,N	7,297
7-03	Kicking Horse	Integrated	G,K,N	11,372
7-04	Glenogle Creek	Integrated		22,295
8-01	Yoho National Park	Protected		128,792
9-01	Sullivan River	Integrated		81,284
9-02	Chatter-Prattle Creek	Integrated		51,686
9-03	Upper Bush River	Integrated	H	11,350
9-04	Bush Arm	Integrated	C,G,K,L,N	13,411
9-05	Lower Blaeberry River	Integrated	B,K,L,N	47,537
9-06	Waitabit to Lyell Creek	Integrated		125,220
9-07	Upper Blaeberry	Integrated	B,K,L,N	21,070
9-08	Blackwater Area	Integrated	B,G,H	30,566
10-01	Hamber Provincial Park	Protected		23,968
10-02	Encampment Creek	Integrated	H	9,071
10-03	Cummins Face	Integrated		7,668
10-04	Lower Wood River	Integrated	K,N	39,466
10-05	Upper Wood River	Special Mgmnt.	B,C,H,J,K,L,N	34,865
10-06	Clemenceau Icefield	Integrated	J	54,090
10-07	Lower Cummins River	Deferred	A,B,C,G,H,J,N	14,769
10-08	Upper Cummins River	Protected		6,383
11-01	Upper Windy Creek	Special Mgmnt.	A,B,H,I,J,L	20,879
11-02	Sir Stanford Range	Special Mgmnt.	I,J,L,N	16,971
11-03	West side Mica Reservior	Integrated		68,919
11-04	Ventego Creek	Integrated	B,K,L,N	15,866
11-05	Upper Ventego - Sorcerer Lake	Integrated	L,N	12,208
11-06	Gold/Batchelor	Integrated	B,L,N	39,476
11-07	Esplanade Ridge	Special Mgmnt.	B,L,N	4,447
12-01	Glacier National Park	Protected		93,970
13-01	Dogtooth Range	Integrated	B,G,K,N	38,535
13-02	Canyon Creek	Special Mgmnt.	A,B,H,J,L,N	12,261
13-03	Lower Quartz Creek	Dedicated	K,N	12,825
14-01	Golden - East side	Integrated	G,K,M	24,221
14-02	Moberly Marshes	Special Mgmnt.	A,B,C,G,H,I,J,K,N	5,089
15-01	Upper Spillimacheen	Special Mgmnt.	B,H,I,J,L,N	6,462
15-02	Lower Spillimacheen	Integrated	B,J,L,N	114,960
15-03	Bugaboo Recreation Area	Protected		11,375
15-04	Frances - Templeton	Integrated	N	31,972
15-05	Forester Creek	Integrated	B,H	16,671
15-06	Horsethief - Toby Creek	Integrated	K,N	61,097
15-07	Jumbo - Upper Horsethief	Special Mgmnt.	B,H,K,L,N	29,842
15-08	Bugaboo Creek	Integrated	H,K,L,M,N	13,491
16-01	Upper Buhl Creek	Special Mgmnt.	A,B,H,J,K,L,	7,079
16-02	Upper Skookumchuck - Lower Buhl	Special Mgmnt.	B,C,H,J,L	19,196
16-03	Lower Skookumchuck	Special Mgmnt.	C,G,H	22,582
16-04	Lower Findlay Creek	Integrated	G,K,L,M	37,085
16-05	Mid-Findlay Creek	Protected		21,823
16-06	Upper Findlay - Purcell Conservancy	Protected		27,021
16-07	Upper Dutch - Purcell Conservancy	Protected		11,525
16-08	Mid Dutch Creek	Protected		31,057
16-09	Lower Dutch Creek	Integrated	B,C,G,L	13,795
16-10	Brewer Creek	Integrated	B,G	12,612
16-12	Upper Toby -	Protected		10,896

	Purcell Conservancy			
16-13	Upper Toby above Mineral King	Protected		3,236
16-14	Contentious Creek - Buhl Plateau	Protected		13,694
16-15	Fir Mountain (north end)	Special Mgmnt.	A,C,G,H,J,L,N	3,794
17-01	Matthew - Mark & Mather Creeks	Integrated		36,805
17-02	White Creek	Integrated	C,H	15,257
17-03	Upper Meachen Creek	Special Mgmnt.	A,H,K	22,624
17-04	St. Mary's Valley	Integrated	C,H	46,607
17-05	Lower Perry Creek	Integrated	H	22,465
17-06	Upper St. Mary's Valley	Integrated	H	74,544
17-07	Dewar Creek - Purcell Conservancy	Protected		13,261
17-08	St. Mary's Alpine Provincial Park	Protected		9,403
18-01	Gold-Joseph Creeks	Integrated		18,583
18-02	Teepee-Caven Creeks	Dedicated		49,509
18-03	Upper Moyie	Integrated	H,K	23,485
18-04	Boundary (Yahk-Bloom)	Integrated		24,725
18-05	Gilnockie	Protected		9,278
18-06	Lower Moyie - Upper Yahk	Dedicated	K	21,828
18-07	Bloom Creek	Integrated	H	9,924
18-08	Lower Moyie	Dedicated	K	61,219
19-01	Sand Creek Face	Integrated		11,972
19-02	Newgate - Eardner	Integrated	H,K	50,775
19-03	Grasmere Range	Integrated	K	5,823
19-04	Jaffray Area	Private		34,830
19-05	Pickering Hills	Special Mgmnt.	G,H,K	11,096
19-06	Bull Mountain	Special Mgmnt.	B,G,H,I,K,N	3,506
19-07	Crown north of Elk River	Integrated	C,K	3,900
19-08	Jaffray Crown	Integrated	K	2,872
19-10	Koocanusa Reservoir	Integrated		6,413
19-11	Private Land on Reservoir	Private		3,487
20-01	Wolf Creek - Wildhorse	Integrated	D,G,K	17,665
20-02	Island Pond	Integrated	G,K	25,522
20-03	Skookumchuk Flats	Special Mgmnt.	C,D,G,H,K	10,055
20-04	Ta Ta Creek - Cherry Creek	Integrated	G,K	19,583
20-05	Cranbrook - Kimberley	Private		76,197
20-06	Mt. Baker - Kootenay River	Integrated	G,K	8,000
20-09	Premier Ridge	Special Mgmnt.	B,G,H	4,638
21-01	Toby Benches	Integrated	D,G,K	48,171
21-02	Windermere Benches	Integrated	D,G,K	21,167
21-04	Columbia Lake & East Side	Special Mgmnt.	A,B,C,D,G,H,I,J,K, L,N	9,023
21-06	Windermere Lake & Marshes	Special Mgmnt.	A,B,C,D,G,H,I,J, K,N	4,394
21-07	Wilmer Wetlands	Special Mgmnt.	A,B,C,D,G,H,I,J, K,N	2,527
21-08	Canal Flats	Private		886
22-01	West Side	Integrated	G,H,I,J,K,N	31,883
22-02	Columbia Marshes	Special Mgmnt.	A,B,C,D,G,H,I,J, K,N	13,350
22-03	Kindersleyto Horse Creek	Integrated	G,H,K	58,746
22-04	Steamboat	Integrated	K	51,259

APPENDIX II

WEST KOOTENAY-BOUNDARY REGIONAL LAND-USE PLAN DESIGNATION BY POLYGON (from Province of British Columbia 1995c)

Management Guideline Categories:

A	Old Growth Dependent Species	I	Visuals
B	Wide Ranging Carnivores	J	Recreation/Sense of Solitude
C	Fisheries	K	Heritage/Cultural
D	Natural Grasslands	M	Coal and General Mining
E	Agriculture (Grazing)	L	Tourism Commercial
F	Alpine/Sub-Alpine	N	Tourism Visuals
G	Ungulate Winter Range	O	Wildlife Habitat Management
H	General Biodiversity	P	Spiritual /Aesthetic

Polygon Number	Unit Name	Designation	Management Guidelines	Area (ha.)
1-1	Highway Corridor to Anarchist	Integrated	C,D,G,K,N	93840
1-2	Uplands	Integrated	H	17144
1-3	Ingram Ridge	Integrated	K	8615
1-4	Phoenix, Eholt Creeks	Integrated	K,N	6121
1-5	Gilpin Grasslands	Special Mgmnt.	D,E,G,H,K,O	3242
1-6	Snowball Creek	Special Mgmnt.	D,E,G,H,O	6766
1-7	Conkle Lake	Protected		953
2-1	Okanagan Highlands	Dedicated	C,K,	27683
2-2	West Kettle River	Integrated	C,K,N	27631
2-3	Lower Kettle	Integrated	C,G,K	35436
2-4	Granby River and Burrel Creek	Integrated	B,C,H	104025
2-5	Mid-Granby River	Protected		18846
2-6	Upper Boundary Creek	Dedicated	K	62188
2-7	Upper Morrel, Lynch Creeks	Protected		10863
2-8	Beaverdale Uplands	Dedicated	K	40692
2-9	Upper Kettle River and Rendell Creek	Integrated	B,C,G,K	54989
2-10	Lower Granby	Integrated	C,D,G,K,N	9426
2-11	Mid Kettle	Integrated	C	15386
2-12	Goatskin	Special Mgmnt.	B,E,F,H,J	13830
2-13	Granby North	Protected		18648
2-14	East Granby Extension	Special Mgmnt.	B,F,H,J,O	11814
2-15	Gable Mountain Extension	Integrated	B,F,H	6183
3-1	Mt. Faith and Lynch Creek	Protected		27009
3-2	South side Texas Creek	Special Mgmnt.	C,G,H,N,K	2824
3-3	Sutherland Creek	Integrated	C,F,G,H,J,N	27741
3-4	West side Christina Lake	Special Mgmnt.	H,I,J,K,N	8369
4-1	Murphy Creek	Integrated	C,K,L,N	27326
4-2	Big Sheep Creek	Integrated	C,F,J,K,N	9982
4-3	East of Nancy Greene Recreation Area	Integrated	F,J,K,L,N	44121
5-1	Stagleap Creek	Special Mgmnt.	A,B,F,H,J,O	3521
5-2	Stagleap Park	Protected		1248
5-3	South Salmo River and Upper Sheep Creek	Special Mgmnt.	A,B,F,H,K,O	18794
5-4	Pend D'Oreille	Integrated	G	22123
5-5	Salmo River and Erie Creek	Dedicated	C,F,J,K,N	127255
5-6	Upper Ymir Creek	Integrated	B,F,H,K,O	10350
6-1	Bayonne, Upper Priest Creeks	Special Mgmnt.	A,B,F,H,J,K,O	18001
6-2	Corn Creek	Integrated	F,H,J,N	17710
6-3	Monk Creek	Special Mgmnt.	A,B,F,H,J,O	4529
6-4	Boundary Creek	Integrated	B	8494

6-5	Boulder Creek	Integrated	H,N	8220
6-6	Creston Wildlife Mgmt. Area	Special Mgmnt.	C,H,K,N	6522
6-7	Fish, Summit Creeks	Integrated	C,K,N	50876
6-8	Creston, Duck Creek	Integrated	K,N	38244
6-9	Arrow Creek Watershed	Special Mgmnt.	H	8636
6-10	Upper Cultus Creek	Integrated	B,F,H,O	17278
7-1	Malandine Creek	Special Mgmnt.	A,B,C,F,H,J,K,O,P	15761
7-2	Upper Kamma, Kid Creeks	Special Mgmnt.	A,H,O	25091
7-3	Skelly, Lower Kianuko Creeks	Integrated	H	8830
7-4	Goat, Moyie, Kitchener Creeks	Integrated	C,K,N	73985
7-5	West Yahk River and Freeman Creek	Integrated		9975
7-6	Hawkins Creek and upper Moyie River	Integrated	H,N	35519
7-7	Upper Kianuko	Protected		11707
8-1	Campbell Creek	Special Mgmnt.	F,H,I,J,N	16152
8-2	Powder to Crawford	Integrated	F,I,J,N	38133
8-3	Sanca, LaFrance Creeks	Integrated	K,N	44379
8-4	Gray, Houghton Creeks	Integrated	H,J,N	12030
8-5	Lockhart Creek	Special Mgmnt.	F,H,I,N,K	3652
8-6	Pilot Peninsula	Special Mgmnt.	G,H,I,J,K,L,N	3072
9-1	Wilson, upper Kutetl Creeks	Protected		19665
9-2	West Arm Kootenay Lake	Special Mgmnt.	G,H,I,J,N	45363
9-3	Upper Blewett	Integrated	J,K	9467
9-4	Lasca, Harrop Creeks	Special Mgmnt.	B,C,H,I,J,N	11112
9-5	Kokanee Glacier Park	Protected		24507
9-6	Midge Creek	Special Mgmnt.	A,B,C,F,G,H,J,N	15105
9-7	Upper Sproule, Grohman Creeks	Integrated	F,J	13915
9-8	Apex Clearwater	Integrated	A,B,F,H,J,N,O	8156
9-9	Upper Redfish, Liard Creeks	Special Mgmnt.	F,H,J	2725
9-10	Kokanee Creek Corridor	Special Mgmnt.	B,C,H,I,J,N	8867
9-11	Selous, Ward Creeks	Protected		2338
9-12	5 Mile, Anderson Creeks	Protected		9722
9-13	Seeman Creek	Integrated	F,H	9857
10-1	Purcell Wilderness Conservancy	Protected		59000
10-2	Carney/Clute Creeks	Protected		33210
10-3	Kootenay Lake (west side)	Special Mgmnt.	C,F,H,I,J,N	33645
10-4	Argenta Face	Special Mgmnt.	G,H,I,J	5431
10-5	Kaslo River	Integrated	B,F,H,J,K,N	18397
10-6	Keen Creek	Integrated	B,F,H	12890
10-7	Upper Coffee, Lendrum Creeks	Special Mgmnt.	B,F,H,J,N	3909
10-8	Whitewater Grizzly, Interpretive Trail	Special Mgmnt.	B,F,H,J,N	2263
10-9	Kootenay Lake (northwest)	Integrated	B,F,H,J,N	26242
11-1	Robson Ridge (along CPR grade)	Integrated	K,L,N	48186
11-2	Syringa Creek	Protected		4498
11-3	Lower Arrow Lake (west side) and Renata Creek	Integrated	K,N,O	41151
11-4	Goose, Ladybird, Cayus, Deer Creeks	Integrated	J,K,N	66257
11-5	Mt. Faith Extension	Special Mgmnt.	B,F,H,J,K,N,O	6431
11-6	Hutchinson Creek	Special Mgmnt.	D,G,H,K,O	12414
11-7	Lower Dog Creek	Special Mgmnt.	B,H,K,N	3469
12-1	Valhalla Park	Protected		49560
12-2	Shannon, upper Wragg Creeks	Integrated	H,L,N	6281
12-3	Upper Wilson, Kane Creeks	Protected		27916
12-4	Main Slocan Valley Corridor	Special Mgmnt.	C,H,I,J,K,L,N	95929
12-5	Koch, Hoder Creeks	Dedicated	B	56612
12-6	Sandon, Idaho Lookout	Integrated	B,F,J,K,L,N	7830
12-7	Lower Bremner, Fitzstubbs, Creeks and Wilson Lake	Integrated	B,C,F,J,O	25426
12-8	Winlaw Creek	Integrated	B,F,J	11982
12-9	Silverton, Enterprise Creeks	Integrated	B,F,J,K,L,N	25021
12-10	Upper Bremner Creek			

	(including Hamling Lake)	Protected		8610
12-11	Wragge Creek Beach	Special Mgmnt.	H,I,J,L	2758
12-12	Robertson Creek	Integrated	B,H,J,K,N	5002
13-1	Mosquito Creek	Dedicated	B,C,F,N	61802
13-2	Octopus Creek to Burton	Integrated	K,N	41588
13-3	Pinnacles	Special Mgmnt.	B,F,H,J,L,N	9124
13-4	Nakusp to height of land	Integrated	C,K,N	63519
13-5	Mid Kuskanax Creek and Halfway River	Integrated	C,H,K,L,N,O	41928
13-6	Caribou Creek	Integrated	B,C,J,K,N	25021
13-7	Snow, Burton Creeks	Dedicated	B,C,J,N	27112
13-8	Lower Barnes, South Eagle Creeks	Integrated	B,C,F,G,J,K,O	79494
13-9	Upper Eagle, Cortianna, Galloping Creeks	Special Mgmnt.	B,F,H,J,	3373
13-10	Upper Barnes Creek	Integrated	B,C,F	16647
13-11	Upper Halfway River and St. Leon Creek	Special Mgmnt.	A,B,C,F,H,J,L,N,O	24743
13-12	Highest elev. in Kuskanax, Halfway Creeks	Special Mgmnt.	A,B,F,H,K,L,N,O	17808
14-1	Cooper, McKian Creeks	Protected		18166
14-2	Lardeau, Cooper, Meadow Creeks	Special Mgmnt.	C,F,H,N,O	38872
14-3	Upper Beaton, Wilkie Creek	Integrated		13186
14-4	Upper Trout Lake Valley	Special Mgmnt.	A,B,F,H,J,L,N,O	31649
14-5	Hill, McKenzie Creeks	Special Mgmnt.	C,K,O	7576
14-6	Upper Ferguson Creek	Integrated	A,B,F,H,J,K,N	22232
14-7	Upper Poplar, Cascade, Meadow Creeks	Protected		19280
14-8	Mobbs, Tenderfoot Creeks	Protected		22999
14-9	Trout Lake Face (southwest)	Protected		6677
14-10	South Asher Creek	Special Mgmnt.	A,B,H,L,O	6629
14-12	Healey Creek	Integrated	A,C,F,H,O	15164
14-13	Lake Creek	Integrated	A,H,	11318
14-14	Hope Creek	Special Mgmnt.	A,C,H,O	4897
14-15	Shore of Duncan Lake	Integrated	K	12015
14-16	Beaton Creek	Integrated	B,F,H,J,L,N,O	8489
15-1	Upper Glacier Creek	Special Mgmnt.	B,F,H,I,J,	6979
15-2	Upper Duncan (northeast)	Integrated	B,F,J,N	31700
15-3	Houston, Duncan Creeks (headwaters)	Integrated	A,B,H,J,O	21367
15-4	Duncan, West Fall, Rivers and East Creek	Integrated	B,H,O	27772
15-5	Lower Glacier Creek	Integrated	B,C,K	43555
15-6	Upper Howser Creek	Integrated	B,F,H,J,	24681
15-7	Marsh, Adams Creeks	Integrated	B,K	16384
15-8	Four Squatters Mountain	Integrated	B,F,J	17860
15-9	Bugaboos	Special Mgmnt.	B,F,H,J,L,N	11272
15-10	Laidlaw Creek	Integrated	B	16626
15-11	Howser Creek	Integrated	B,H	10016
16-1	Fish, Incomapleux Rivers	Integrated	B,C,H,K,L,O	20495
16-2	Revelstoke (bottom land to Grahams Creek)	Special Mgmnt.	G,H,K,O	5024
16-3	Upper Arrow Lake (east and west side)	Integrated	K,L,N	54920
16-4	South Fosthall Creek (upland on west side)	Dedicated	B,F,J,N	64337
16-5	Monashee Park	Protected		7424
16-6	Upper Akokolex, Crawford Creeks	Integrated	B,F,J,K,L	69718
16-7	Battle Mountain, and upper Boyd Creek	Integrated	B,F,J,K,L	39991
16-8	Mt. McKenzie and McKay Creek	Integrated	B,F,L,N	4399
16-9	Fostall, Odin Creeks	Special Mgmnt.	B,F,H,J,L	17324
17-1	Downie Creek	Special Mgmnt.	A,B,C,F,H,J,L,N,O	55096
17-2	West Jordan River and Frisbee, Big Eddy Creeks	Integrated	B,C,F,H,J,O	57422

17-3	Columbia River Bottom Land (south portion)	Special Mgmnt.	A,B,C,G,H,K,N,O	36880
17-4	Keystone Standard	Integrated	B,F,H,J,K,L,N,O	22836
17-5	Illecillewaet River and Greely Creek	Integrated	B,C,K,L,N	11028
17-6	Liberty Creek	Special Mgmnt.	B,F,H,J,K,L,O	18167
17-7	Revelstoke National Park	Protected		26042
17-8	Illecillewaet, lower Tangier Rivers	Integrated	B,C,F,J,K,L,N	40325
17-9	Frisbee Ridge	Integrated	B,F,G,H,J,O	12440
17-10	Upper La Form, upper Carnes Creeks	Integrated	B,F,H,J,L,N,O	28443
17-11	Goldstream River (along reservoir)	Special Mgmnt.	A,B,H,J,L,O	5212
17-12	Upper Tangier River	Special Mgmnt.	A,B,F,H,J,L,O	28187
17-13	Glacier National Park (west side)	Protected		41746
17-14	Fissure Creek	Integrated	B,F,H,J,K,L	14968
18-1	Soards Creek	Integrated	B,F,H,O	27221
18-2	Upper Goldstream River and Stitt Creek	Special Mgmnt.	B,F,H,J,L,N,O	36531
18-3	Lower Goldstream River	Special Mgmnt.	B,H,J,K,L,N,O	10114
18-4	Low elev. upper Columbia River	Special Mgmnt.	B,C,H,K,L,N,O	34725
18-5	Revelstoke Reservoir (upper east side)	Integrated	B,F,J,K,N,O	93446
18-6	Scrip, Pat Creeks	Integrated	B,C,F,H,O	44011
18-7	Horne Creek	Integrated	B,F,H,K,L	10588
18-8	Goldstream River (south side)	Integrated	B,F,H,J,K,N,O	9929
18-9	Argonaut, Nicholls Creeks	Integrated	A,B,F,H,J,K,N,O	35924
18-10	Hoskins, mid-Kirbyville Creeks	Special Mgmnt.	B,F,H,J,K,L,O	20251

APPENDIX III

COLUMBIA MOUNTAINS RESERVE SYSTEM
PROTECTED AREA CLASSES
(from Frost 1994)

RESERVE CLASS	RESERVE NUMBER	NAME	SIZE (ha.)
IA	1	North Monashee Range	71,074
IA	2	Scrip Range	76,877
IA	3	Westfall River/Laidlaw Ck.	29,059
IA	4	East/Geigerich Creeks	34,913
IA	5	Mt. Faith/Gladstone	64,946
IA	6	Gold Range	45,779
IA	7	Goat Range	74,201
IA	8	Central Purcells	242,547
IA	9	Windy Range/Upper Goldstream	74,492
IA	10	Valhalla Range	50,490
IA	11	Upper Granby River	39,424
IA	12	West Arm	68,516
IA	13	Upper Goat/Kianuko Creek	28,768
I	14	Cameron Creek	4,334
I	15	Baribeau Creek	5,067
I	16	Louis Lee Creek	13,011
I	17	Liberty/Fissure Creeks	12,235
I	18	Jordan River/Bews Creek	30,894
I	19	Lockhart Creek	3,893
I	20	Hall/McKenzie Creeks	5,992
I	21	Lake Creek	11,582
I	22	Mobbs/Tenderloin Creeks	20,675
I	23	Stagleap Provincial Park	1,152
I	24	West Kettle River Headwaters	43,500

RESERVE CLASS	RESERVE NUMBER	NAME	SIZE (ha.)
I	25	Okanogan Mountain	24,520
I	26	Mt. Christie	5,594
I	27	Goat Creek	12,315
I	28	Valkyr Range	29,216
I	29	Corn Creek	5,683
I	30	Gilnockie Creek (core)	13,326
I	31	Kokanee Glacier	41,872
I	32	Glacier National Park	135,508
I	33	Hunters Range	20,845
I	34	Mt. Revelstoke	33,897
I	35	Lew Creek	815
II	36	Creston Marshes	8,184
II	37	Gilpin grasslands	20,339
II	38	Gilnockie Creek addition	15,430
II	39	Columbia River marshes	32,968
II	40	Goat Creek addition	2,456
II	41	Lower Bone Creek addition	12,196
II	42	Soards/Pat/Nagle Creeks	74,449
II	43	Serenity Peaks	90,787
II	44	Shuswap Arm	11,545
II	45	Lower Jordan River	9,655
II	46	Upper Seymour River	29,004
II	47	Blanket/Greenbush Creeks	19,522
II	48	Whatshan Range	29,012
II	49	West Flank Granby River	25,589
II	50	East Flank Granby River	45,209
II	51	Okanogan Mtn. extension	25,205

RESERVE CLASS	RESERVE NUMBER	NAME	SIZE (ha.)
II	52	Lower Lardeau River	13,190
II	53	Kokanee/Sitkum Creeks	19,693
II	54	Howser Creek	27,692
II	55	Mt. Mara	12,726
II	56	Kelly River	8,160
II	57	Upper Rock Creek	8,449
II	58	Mt. Christie extension	5,279
II	59	Redding/Meachen Creeks	76,537
II	60	Big Sheep Creek	23,192
II	61	Syringa Creek	5,954
II	62	South Salmo/Priest Rivers	17,524
II	63	Columbia Lake grasslands	8,360
II	64	Skookumchuck Creek	67,105
II	65	St. Leon Creek	10,532

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